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REPORT

OF

PROFESSOR JOSEPH HENRY,

SECRETARY OF THE SMITHSONIAN INSTITUTION,

FOR

THE YEAR 1867.

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To the Board of Regents of the Smithsonian Institution:

GENTLEMEN: The close of the year 1866 completed the second decade of the actual operations of the Smithsonian Institution. It was chartered in August, 1846; though but little more was accomplished during that year than a discussion of plans, and the appointment of the Secretary, the principal executive officer.

On thus commencing a new decade in the history of the Institution, we may pause a few moments to recall some facts relative to the character, the acceptance, and the administration of the endowment of Smithson, which it is important always to keep in view. This will be evident when we reflect on the changeable character of the bodies constituting the guardians of the trust. Not a single Regent on the list of those originally appointed is now a member of the board, and indeed, with perhaps one single exception, all the members of Congress and the principal officers of the general government have been changed, and in some cases many times in succession. Under these circumstances it becomes desirable that frequent reference should be had to the original principles on which the Institution was founded, as well as to those on which its affairs are now conducted.

The endowment was one of no ordinary character; it was confided to our government not by one of its own citizens, but by a distinguished foreigner, the scion of an ancient house renowned for its achievements in English history. It was not given in trust to our government to be disposed of for the exclusive benefit of a portion of our own people, or even for that of the whole nation, but in behalf of the general family of mankind, for the benefit of men of all coun-

tries and of all times. It was not restricted in effect to the diffusion of a knowledge of old truths, but primarily designed for the extension of the boundaries of thought by the promotion of the discovery of new powers of nature, of new principles and new laws of the universe. Nor was the acceptance of the trust an ordinary occurrence. It became a constitutional question whether the Congress of the United States was legally authorized to assume the responsibility and discharge the duty of a trustee for such a purpose; nor was it until after the expression of many doubts as to the result, that the acceptance was finally resolved on. Again, one of our most distinguished citizens, Hon. Richard Rush, who had previously represented our government at the court of St. James, was chosen as the agent to effect a transfer of the funds to this country, and this he was enabled to do without the delay of protracted legal proceedings, through the courtesy of the court of chancery in granting a decree to that effect, after a mere formal suit to satisfy the requirements of law.

A trust of so novel a character, confided by a prominent citizen of England, not to his own government, but to that of the United States, could not fail to attract general attention and place in a conspicuous light before the world, the integrity, intelligence and executive ability of the party accepting an office of so much responsibility and difficulty as that of the trustee of this endowment.

The obligation became more impressive in consideration of the fact that the trust was accepted after the decease of him by whom it was confided, and who could, therefore, give no further indications of his intentions than those expressed in the terms of his will. It was, consequently, of the first importance that these terms should be critically studied, logically interpreted, and the intentions deduced from them be strictly followed. Unfortunately, however, at the time the bequest was accepted, the public at large were so little acquainted with the distinctions of science, or so little regardful of the precise ideas to be attached to the terms which it employs, that it is scarcely a matter of surprise that the intention of Smithson, as expressed by the words "for the increase and diffusion of knowledge among men" should have been misinterpreted, and that the act of Congress organizing the Institution should include provisions which have since been generally recognized as incompatible with the leading objects of the bequest.

It is, however, a sacred duty on the part of the government, which it owes to its own character for candor and equity, to correct, as far as possible, any errors which misapprehension or inad-

vertence may have engrafted on its legislation, and to remove any burdens which may have been injuriously imposed on the endowment; and we doubt not from what has been done in the last few years, that Congress will in due time fully vindicate the integrity of its purposes, and enable the legacy of Smithson to perform all the good which his most ardent desire could have anticipated.

It has been evident from the first that it was the intention of Congress to deal not only justly but liberally with the Institution. It restored the fund with interest when temporarily lost by a loan to one of the western States, and provided for its subsequent security by declaring it forever a deposit in the treasury of the United States, on which six per cent. interest, payable semi-annually, should be allowed. It furnished from the public domain grounds for a spacious park, as well as a site for a large building; and to increase, as it was thought, its popularity, the new Institution was made the custodian of the national museum. These acts, though prompted by a liberal spirit, proceeded on the erroneous idea then prevalent, that the intentions of Smithson could be properly carried out by an institution consisting of objects of a material and local character. Fortunately, however. Congress did not restrict the expenditure of the income of the fund to these, but allowed the Regents at their discretion to devote a portion of it in such other manner as in their opinion might be best fitted to carry out the intentions of the donor.

After much deliberation, with a view to reconcile conflicting opinions, an arrangement was effected by which two distinct systems were provisionally adopted. The first of these which was included in the law of organization, contemplated the expenditure of the income in the formation and embellishment of an extensive park, or pleasure ground, in which rare and ornamental trees and shrubs of different species should be cultivated; in the erection and maintenance of a castellated building, which, from its dimensions and imposing architectural design, should be an ornament to the city and a monument to the founder; in the formation of a gallery of art in which should be exhibited choice specimens of painting, sculpture and engraving; in the establishment of a library consisting of works on all subjects; and, finally, in the support of a national museum containing the collections of the United States Exploring Expedition, and all the specimens that might be accumulated from other sources for the illustration of all branches of natural history, geology, ethnology, etc.

The objects included in this system are all in themselves highly interesting and very desirable for the embellishment and intellectual improvement of the capital of the United States, but they are not in

accordance with the will of Smithson, and fail entirely to realize his higher and more comprehensive conceptions. They do not serve to "increase knowledge," or, in other words, to add new truths to the existing stock; nor do they "diffuse knowledge among men," since they are local in character, and fail to promote the general welfare of mankind. Neither could they all be properly supported from the limited income of the Smithson bequest. A library, and more especially a museum, worthy of the nation, would, either of them, in time, absorb the whole of the annual income.

The other system, above referred to, or that which has been denominated the system of active operations, was suggested by the desire to strictly realize the intentions of Smithson, both as regards the increase and the diffusion of knowledge; and this it was proposed to effect by instituting experiments or researches in all departments of science; by making explorations relative to geology, natural history, ethnology, and meteorology, and by diffusing an account of the results of all these, through the press, to every quarter of the globe. It further includes in its design the collection and labelling of large numbers of duplicate specimens, to illustrate the branches above mentioned, not merely to be deposited in a national museum, but, also, to be distributed to colleges, academies, and other establishments, for educational purposes; and, lastly, embraces in its plan an extended arrangement for international exchanges, through which the discoveries of science and the products of literature of the old and new worlds, become the common elements of intellectual progress. This system, which is immediately suggested to those familiar with scientific language, by the terms of the bequest, is a living, active organization, calculated to produce, unceasingly, results of which the value will everywhere be known and be properly appreciated. It was not, however, adopted, even provisionally, as a prominent feature of the organization without strenuous opposition, particularly on the part of the advocates of the proposition to apply the Smithson endowment to found a national library. Indeed the ideas which it involved were in advance of the times. That an institution could be established which might have an important bearing on the welfare of the world without the adventitious aid of palpable objects, was not generally comprehended.

But though restricted in its operations by limited resources and subjected to popular opposition, the system has proved in its operation to be eminently practical, and has established for the Institution a reputation as wide as civilization itself. It has connected the name of Smithson with the progress of almost every branch of science, and

has thus furnished the means of perpetuating his memory far more effectually than could be done by architectural or other local monuments, however ample in dimensions or comprehensive in design.

Instead of being, as has been supposed, adverse or neutral as regards the interests of the city of Washington, it has given it a reputation as a centre of scientific operations, and has led to a series of improvements which, in time, cannot do otherwise than promote its renown and add to its prosperity. It does not oppose an antagonism to the local objects before mentioned, but seeks to establish them on a more liberal scale by other instrumentalities. While it has distributed its publications and specimens with unprecedented liberality, it has been fully repaid with articles of a similar character. Through its exchanges it has collected a library of scientific reference superior to any in this country, and equal to any which can be found abroad. As soon as Congress shall furnish the means of supporting a national museum, it will supply this with all the foreign and domestic specimens necessary for comparison and illustration.

The two systems, at first carried on harmoniously, though in a limited way and not without mutual embarrassment, were soon found in practice to be radically incompatible with each other. As it was impossible suitably to control the expenditure on the local objects, it has been the constant policy of the Directory of the Institution to obtain relief from these burdens. It was in accordance with this that the government was solicited to resume the care of the grounds, on which had been expended annually a considerable portion of the income, and to make these grounds part of a general park extending from the Capitol to the Potomac. It was for this purpose that the Institution was instrumental in procuring the services of Mr. Downing, whose plan of the grounds in question would have been completed had not the work been interrupted by his untimely death. This work, we trust, will soon be resumed under more favorable auspices.

It was also in accordance with the policy under consideration that the valuable library which, from its rapid increase by exchanges, had already exceeded the means at the disposal of the Institution for its support, was incorporated with that of Congress.

Happily the necessity for supporting a gallery of art has been obviated by the enlightened munificence of a citizen of Washington, W. W. Corcoran, esq., who has erected a building and made provision for the support of such an establishment to which the collections in this department already formed by the Institution may be transferred.

The next important desideratum is the relief of the fund of Smithson from the greatest of all the burdens which have been imposed upon it, that, namely, of the expense involved in the care and exhibition of the national museum. For carrying on the active operations a building not to exceed a cost of seventy-five thousand dollars would have been amply sufficient, both in regard to the accommodations necessarily required and the architectural embellishments which might be thought requisite for such a structure; while the present building, the erection of which was especially urged on the ground of the necessity of providing accommodations on a liberal scale for a national museum and library, has cost to the present time $450,000, or, in other words, besides the $240,000 of accrued interest originally appropriated to the building, an outlay of not less than ten thousand dollars annually for twenty years has been devoted to the same purpose, and this expenditure must, without the relief desired, be not only continued but increased for years to come.

Though great advances have been made in the favor with which the Institution is regarded by the public, and the increased facilities which have been afforded by the transfer of the objects we have mentioned to the care of government, yet the absorption of the income by the museum and the building is so great and accelerative that unless Congress, in justice to the trust, takes upon itself the charge of these objects or provides for their maintenance the active operations must be greatly diminished in efficiency, if not ultimately abandoned. The reputation of the Institution and of the country is however too much involved in the continuance of the active operations to allow them to be abolished or even restricted. Every academy, every college, every lyceum in the United States, as well as all the literary and scientific institutions of Europe, Asia, and even those of Africa and Australia, are interested in the continued success of the system. Furthermore, it be truly said that to devolve the care of a national museum on the Smithson fund is not only an act of injustice to the bequest, but is at once injurious to the reputation of the institution and that of the government, since the means which the former can devote to this purpose after defraying other expenses are entirely inadequate to the support of a museum entitled to the name of "national." A public museum, properly organized as a means of popular education, or as an aid to the advancement of science, should not only be furnished with extensive apartments for the proper accommodation and exhibition of the articles, to be increased from time to time, but it should also be provided with several professors, each learned in a special branch of general natural history. So extended have these

departments of science become that no one individual can be profoundly acquainted with more than one or two of them; hence, in order that a director should properly perform the duties of a curator of an establishment of this kind, he should have a corps of learned assistants. For example, for the preservation and practical use of an herbarium, the constant attendance and supervision of a botanist is requisite, whose duty it will be to classify the specimens, to render them unassailable by insects, to arrange them for study or exhibition, and to be always present to assist those who may desire to examine them, either for elementary study or original research. Without a number of assistants in the line of natural history, a museum must principally consist of mere articles of curiosity, of comparatively little use in the way of valuable instruction. It is evident, however, that a corps of such assistants, supported on permanent salaries, in addition to the other expenses of the museum, would soon absorb the whole of the Smithson income.

What has been said has reference merely to the impropriety of attempting to maintain a museum worthy of the nation at the expense of the Smithson fund, and is not intended to disparage the value of a complete representation of the natural products of America, with such foreign specimens as may be required for comparison and generalization. This we think of great importance, particularly as a means of developing and illustrating our industrial resources, as well as of facilitating the study of the relations of our geology, mineralogy, flora and fauna to those of the old world; and, indeed, the wants of the government appear to demand a collection of this kind, since the Medical Department, the Agricultural Department, and the General Land Office are each rapidly accumulating articles of illustration, and find the necessity for the permanent employment of persons well skilled in the branches to which their specimens pertain. With these the national museum, of a general character, would maintain relations of co-operation and mutual assistance.

It will be seen in previous reports, that from the first, in order to compensate in some degree for the great outlay on local objects, measures were adopted for the increase of the capital of the endowment. These principally consisted in deferring the completion of the building for a series of years, and in the meanwhile investing the money appropriated for its construction, as well as a portion of the annual income, saved by judicious and economical management, in government and State stocks. These stocks, however, were not permanently secured, and were in danger of being disposed of injudiciously, upon casual or inadequate considerations. It has, there-

fore, been a matter of solicitude to obtain for them a permanent investment.

In view of this, a petition was presented to Congress by the board of regents, asking permission to make additions to the principal of the Smithson fund. This petition was granted by the act of February 8, 1867, allowing the regents to increase the principal in the treasury of the United States, by savings, donations, and otherwise, to any sum not exceeding a million dollars, the additions to be subject to the same conditions as the original bequest. In accordance with this law the regents authorized the sale of all the stocks owned by the Institution, excepting those of Virginia, and the application of the proceeds to the increase of the principal to $650,000, which amount is now the permanent fund of the Institution. In addition to this the Institution has $72,500 in Virginia State bonds, the marketable value of which is about $30,000.

The fund first paid into the treasury from the Smithson bequest was $515,169; the remainder of the legacy, which had been left in England as the principal of an annuity to the mother of the nephew of Smithson, was $26,210 63, making in all, from the bequest of Smithson, $541,379 63. The capital has, therefore, been increased more than a hundred thousand dollars, notwithstanding the expenditure of $450,000 on the building.

It will be seen by the reports of the building committee and architect, that the main building of the Institution, which consists of a large central edifice, 200 feet long, 50 feet wide, with two projecting towers and a middle space in front, and a single large tower in the rear, to which portions the damage by fire was principally confined, will be entirely restored in the course of a few months, with the exception of the large hall in the second story. These parts of the building, in which it is proposed to deposit the more valuable collections, are entirely of fire-proof materials. The cost of this reconstruction will amount to $125,000, exclusive of that of the fitting up of the large room just mentioned. The accommodations which will be afforded are amply sufficient for the active operations of the Institution for all coming time, and also for the museum, provided but few additions be made to the number of specimens exhibited; but if the increase be continued—and it is almost impossible to prevent, even if desired, the growth of an establishment of this kind—the completion of the main hall and the fitting it up with cases will become necessary, at an expense of at least $50,000. The other parts of the building, namely, the two wings and connecting ranges, with six towers, will

also require, in time, for rendering them fire-proof, a further cost of not less than $50,000.

The question then occurs, from what sources are the funds necessary for this purpose to be derived? Fortunately the permanent capital of the Institution is now secure and cannot be expended. The income, however, which, in justice and good faith, ought to be applied to the "increase and diffusion of knowledge among men," should not be mortgaged, as it were, for years to come, in providing accommodations for the government collections. Surely the intelligence of the general public and the moral sense of the community will justify Congress in making seperate provision, on a proper scale, for the support and extension of a government museum.

The large drafts upon the income since the fire and the high prices of labor and materials have interfered with as vigorous a prosecution of the active operations as was exemplified in previous years, and have induced us to discontinue some enterprises in which we were engaged, and to postpone others until a more favorable opportunity. It will be seen, however, by the following report of the operations of the Institution for the past year that much has been accomplished in the way of sustaining and advancing the reputation of the establishment:

Publications.—The greater part of the expenditures on publications during the past year has been for the printing and paper of an edition from the stereotype plates of volume XIV of the Contributions to Knowledge, and volumes VI and VII of the Miscellaneous Collections. These volumes had been published in previous years in a sufficient number of copies to supply foreign exchanges, but owing to the large demands on the income of the funds on account of the repair of the building, we were unable at the time to distribute copies to American libraries. The edition which has now been printed will, however, serve to make up all our deficiencies in this respect.

The articles contained in volume XIV of the Contributions are:

1. Discussion of the Magnetic and Meteorological Observations made at the Girard College, Philadelphia, by Prof. A. D. Bache. Parts 7–12.

2. On the Construction of a Silvered-glass Telescope, fifteen and a half inches in aperture, and its use in Celestial Photography, by Prof. Henry Draper.

3. Palæontology of the Upper Missouri, by F. B. Meek and F. V. Hayden. Part I.

4. Cretaceous Reptiles of the United States, by Dr. Joseph Leidy.

The contents of volume VI of the Miscellaneous Collections are:

1. Monograph of the Diptera of North America, by H. Loew. Edited by Baron R. Ostensacken. Parts 1 and 2.

2. List of the Coleoptera of North America, by Dr. Jno. L. Le Conte. Part 1.

3. New Species of North American Coleoptera, by Dr. Jno. L. Le Conte.

Volume VII, Miscellaneous Collections, contains:

1. Monograph of the Bats of North America, by H. Allen, M. D.

2. Land and Fresh-water Shells of North America. Part 2. Pulmonata, Limnophila, and Thalassophila, by W. G. Binney.

3. Land and Fresh-water Shells of North America. Part 3. Ampullariidæ, Valvatidæ, Viviparidæ, Fresh-water Rissoidæ, Cyclophoridæ, Truncatellidæ, Fresh-water Neritidæ, Helicinidæ. By W. G. Binney.

4. Researches upon the Hydrobiinæ and allied forms. By Dr. Wm. Stimpson.

5. Monograph of American Corbiculadæ, recent and fossil. By Temple Prime.

6. Check-list of the Invertebrate Fossils of North America, Eocene and Oligocene. By T. A. Conrad.

7. Check-list of Fossils, Miocene. By F. B. Meek.

8. Check-list of Fossils, Cretaceous and Jurassic. By F. B. Meek.

9. Catalogue of Minerals, with their formulas, etc. By T. Egleston.

10. Dictionary of the Chinook Jargon or Trade Language of Oregon. By Geo. Gibbs.

11. Instructions for Research relative to the Ethnology and Philology of America. By Geo. Gibbs.

12. List of Works published by the Smithsonian Institution.

Of the two works mentioned in the last report as being in the press, the first, entitled "Astronomical, Magnetic, Tidal, and Meteorological Observations within the Arctic Circle, by Isaac I. Hayes, M. D.," has been completed and a small edition printed. A full description of this paper was given in the report for 1865. It forms a quarto volume of 283 pages, illustrated with six charts and fifteen wood-cuts. The principal chart shows the discoveries, tracks and surveys of the Arctic expedition of 1860 and 1861, projected on a scale of 1 to 1,200,000. Another chart shows the vicinity of Port Foulke, the winter-quarters in 1860 and 1861 of the

expedition, projected on a scale of 1 to 170,000; a third gives the Iso-magnetic lines in the vicinity of Smith's strait, and three other plates illustrate the series of tides at Port Foulke.

The second work published during the year is "Results of Meteorological Observations made at Brunswick, Maine, between 1807 and 1859, by Parker Cleaveland, L.L.D., Professor in Bowdoin College." Another quarto work in press, and nearly ready for distribution, is entitled: "Results of Meteorological Observations made at Marietta, Ohio, between 1826 and 1859, inclusive, by S. P. Hildreth, M. D.; to which are added, results of observations at Marietta, by Mr. Joseph Wood, between 1817 and 1823," which have been reduced and discussed at the expense of the Institution, by Charles A. Schott. For an account of these works see the part of this report relative to meteorology.

Additional copies of the following works have been printed during the year from the stereotype plates: Draper's Telescope; Whittlesey's Drift; Meek's Check list of Fossils; Catalogue of Birds; Chinook Jargon; List of Coleoptera; Review of American Birds; List of Publications; List of Foreign Correspondents.

The following are the rules of distribution of the Smithsonian publications:

1. They are presented to all learned societies of the first class which publish transactions, and give copies of these, in exchange, to the Institution.

2. To all foreign libraries, of the first class, provided they give in exchange their catalogues and other publications, or an equivalent, from their duplicate volumes.

3. To permanently endowed colleges in actual operation in this country, provided they furnish in return meteorological observations, catalogues of their libraries and of their students, and all other publications issued by them relative to their organization and history.

4. To all States and Territories, provided they give in return copies of all documents published under their authority.

5. To all incorporated public libraries in this country, not included in any of the foregoing classes, now containing 10,000 volumes, and to smaller libraries where a whole State or large district would be otherwise unsupplied.

Institutions devoted exclusively to the promotion of particular branches of knowledge receive such articles published by the Institution as relate to their objects. Portions of the series are also given to institutions of lower grade not entitled under the above rules to

the full series, and also to the meteorological correspondents of the Institution.

For the purpose of collecting materials for the preparation of a report on the present condition of school architecture, a letter was addressed to the officers of public instruction in our principal cities, requesting the use of the architectura illustrations of their most approved school-houses. This request was readily complied with, and a considerable number of wood cuts had been received, when Congress organized the Department of Education, to which it was thought proper to transfer them, with the understanding that they should be used in the report to be published under the direction of the Commissioner. The thanks of the Institution are due to Messrs. Philbrick, of Boston; Shippen, of Philadelphia; Van Bokkelen, of Baltimore; Swett, of San Francisco; Pickard, of Chicago; Randall, of New York; Brooks, of Springfield, Illinois; and Hart, of Trenton, New Jersey, for the promptness of their compliance with our request, as well as for the illustrations actually furnished.

The report for the year 1866, with the appendix, was printed by order of Congress, and the usual number of ten thousand extra copies struck off for distribution, 4,000 by the Institution and 6,000 by the members of the Senate and House of Representatives. It is believed that few, if any, of the government documents are more in demand by the public than this report, and it has become impossible to supply all who make application for it. Unless a larger number be ordered by Congress, the distribution must in future be more strictly conformable to the rules which have been adopted, viz:

1st. To colleges, libraries and societies' publishing transactions.

2d. To contributors to the library, museum or meteorological department of the Institution.

3d. To persons engaged in teaching or in special research, and to collaborators of the Institution.

The changes in the population of the country are so rapid that we cannot be guided by a permanent list. As a general rule, the distribution can only be made to those who make special application for each volume, excepting donors to the museum and meteorological observers.

The volume for 1866 contains, in addition to the report of the Secretary, giving an account of the operations, expenditures and condition of the Institution for the year, and the proceedings of the Board of Regents to February 22, 1867, the following articles:

A sketch of the services of the late Hon. W. W. Seaton, in con-

nection with the Smithsonian Institution, and some notices of his life and personal character. A memoir of Magendie, by M. Flourens, secretary of the French Academy of Sciences. A translation from the German, on the senses of taste, hearing, and sight. A lecture on the results of spectrum analysis applied to the heavenly bodies, by W. Huggins, of England. A translation from the German of an article on the external appearance of the sun's disk, and one from the French on accidental or subjective colors, by Abbé Moigno. A continuation of the series of articles, by Plateau, on the figures of equilibrium of a liquid mass withdrawn from the action of gravity. The annual report of transactions of the Society of Physics and Natural History, of Geneva. Original communications relative to the Tinneh or Chepewyan Indians, of British and Russian America, by Messrs. B. R. Ross, W. L. Hardisty, and S. Jones, of the Hudson's Bay Company, by Geo. Gibbs, esq. An article on the aboriginal American migration, by F. Von Hellwald. An original paper on Indian pottery, by Chas. Rau, esq. An original article on artificial shell deposits of the United States, by Dr. D. G. Brinton. A sketch of ancient earthworks, by I. Dille, of Ohio. The pile-work antiquities of Olmutz, translated from a Vienna periodical. An account of antiquities on the banks of the Mississippi river and Lake Pepin, by Dr. L. C. Estes. Communications on a physical atlas of North America, by Geo. Gibbs, esq., and on ethnological research, by Dr. E. H. Davis, with tables of measurements, by Scherzer and Schwarz. Translation of the prize questions of the International Archæological Congress. An article on vitality, by Rev. H. H. Higgins. Instructions for collecting land and fresh-water shells, by James Lewis, esq. Instructions for collecting myriapods, phalangidæ, etc., by Dr. H. C. Wood. Notes on a plan of a research upon the atmosphere, by Professor C. M. Wetherill. An account of the cryolite of Greenland, by Messrs. Lewis and sons. Extracts from the meteorological correspondence of the Institution, with remarks by the secretary, Professor Henry. On horary variations of the barometer, by Marshal Vaillant, with note by the secretary. On the formation of ice at the bottom of rivers, by Mr. Engelhardt. An account of the earthquake in eastern Mexico on 2d January, 1866, by Dr. C. Sartorius. Statistics relative to Norwegian mountains, lakes, and the snow-line, by O. E. Dreutzer.

These articles embrace a wide range of subjects, and, with a single exception, were either prepared expressly for the Institution or translated from foreign journals not readily accessible to the American reader. The illustrations, *seventy* in number, were prepared at

the expense of the Institution. The translations continue to be made with spirit and fidelity by C. A. Alexander, A. M., of Washington, whose services in this connection for many years have been frequently referred to in previous reports.

Meteorology.—In order to advance those branches of science which depend especially upon instrumental observations, two kinds of labor are necessary; that which is devoted to the making and recording observations, and that which is expended in reducing and discussing them. The first, which frequently requires a large number of observers, as in the case of simultaneous meteorology, fortunately can be performed by persons having a limited amount of scientific training, although the precision and value of their observations are much enhanced by a critical knowledge of the principles upon which the observations depend; while the discussion and reduction require a knowledge of mathematical analysis, possessed by comparatively few; and hence it is not surprising that the accumulation of crude observations should be far in advance of their philosophic discussion, or that at the present time the great desideratum in meteorology is a full discussion, on a general plan, of all the series of observations which have been recorded. If this were properly executed, we should be prepared to commence a new era in this branch of science, and to direct attention to new points of investigation, from indications furnished by the discussions.

In consideration of this state of meteorological data we have concluded, in view of the improvement of the funds, to resume the general discussion of the material which the Institution has already accumulated. We have accordingly commenced this work by the reduction and discussion of all the observations on the *rain-fall* of the North American continent, the results of which are much called for on account of their agricultural, manufacturing, commercial, and sanitary applications. Observations from upwards of twelve hundred localities are now in the hands of the computers, and it is expected that the results will be ready for publication towards the close of 1868. After having discussed all the observations which have been previously recorded, we shall then be prepared to commence a new and more extended series relative to precipitation, and for this purpose we have had prepared a large number of measuring scales, consisting of slips of box wood graduated to the tenth of an inch, to be distributed very generally over the country, with instructions for the observation and record of rain-fall. After carefully considering the

several forms of rain gauges, we have decided to recommend the general adoption of a simple cylindrical vessel of three or four inches in diameter and nine inches high, the depth to be measured by plunging to the bottom a small slip of soft wood on which the water mark can be distinctly observed, and measuring this by the scale before mentioned, the depth being recorded to the quarter of a tenth of an inch. Special instructions will be given that the rain be measured immediately after the fall or before any sensible evaporation has taken place. We have adopted the simple cylinder of uniform diameter as being less liable to errors of observation than any other form.

Although the separate observations are not read with the same minuteness as in the case of gauges in which the depth of rain is magnified by a receiver of less diameter than the orifice of the gauge, yet the average we find from experience in the case of a long series gives equally reliable results with those in which instruments of apparently greater precision are employed.

After the completion of the rain tables, our computers will commence the discussion of the temperature of the North American continent. Were our funds sufficient, we should be glad to include in the investigation all the observations made on this continent during the various expeditions to the arctic regions, undertaken by the British government, few of which have, as yet, received that thorough examination necessary to obtain from them the general truths which constitute real contributions to science.

We have mentioned in previous reports that the meteorological system of the U. S. army was about to be reorganized under the Surgeon General. This work has been carried on during the year, and a series of standard instruments has been constructed by James Green, of New York, under the direction of Dr. Craig, for distribution to the various posts. Fifty barometers and one hundred and fifty thermometers and rain gauges will be substituted for those now in use.

The number of Smithsonian observers during the year 1867 was 385, and this will probably be increased during the year 1868, so that a more rapid and accurate accumulation of data relative to the meteorology of this country will be obtained than at any time heretofore.

The Department of Agriculture has continued during the past year to publish the monthly bulletin of meteorological observations, which is still received with much interest by farmers, as well as by meteorological observers. The preparation of the meteorological notes for

the present, as for previous years, has been in charge of Mr. Wm. Q. Force.

The importance of meteorological observations in their connection with agriculture is becoming better appreciated by the public, and we think it probable that in due time our government will follow the example of foreign countries in maintaining a more perfect series of observations than has as yet been established. The average temperature of the year and of the different seasons, the amount and frequency of rain, the time of early and late frosts, the length of the "growing summers" and the recurrence of years of abnormal drought or of low temperature, are all elements of great value in comparing the relative capacity of different parts of the country for special productions.

We have repeatedly stated in previous reports that our eastern seaboard is far more favorably situated in regard to the prediction of the occurrence of storms than the western coast of Europe, since it has been conclusively shown that the principal disturbances of the atmosphere in the temperate zone move from west to east. During the past year the attempt has been made by the Institution to resume with the co-operation of the telegraph lines the system of telegraphic indications of the weather which was interrupted by the war. We have, however, been unsuccessful, and indeed it can scarcely be expected that without some remuneration to the companies, the use of the telegraphic wires and the time of the operators should be given for the purpose.

The discussion and reduction of long series of observations of the weather at particular places have been continued. The contributions of this kind completed during the past year are deductions from the meteorological observations made at Brunswick, Maine, and Marietta, Ohio. The discussions and reductions were made at the expense of the Institution by Mr. Charles A. Schott, on the same plan as that adopted in the discussion of the observations in the Arctic Regions by Kane, McClintock and Hayes.

Between the years 1807 and 1859 inclusive, meteorological records were made with great regularity by the late Professor Parker Cleaveland, of Bowdoin college, at Brunswick, Maine, and after his death were consigned to this Institution for reduction and publication. The observations, though not intended by their author to be of a strictly scientific character, were yet found sufficiently valuable to warrant the expenditure of considerable labor in preparing them for the press.

Brunswick is on the Androscoggin river, about 25 miles N. 40° E.

from Portland, Maine, in latitude 43° 54′ 5, longitude 69° 57′ 4, and 74 feet above high water. The observations were made at 7 a. m., 1 p. m. and 6 p. m., and relate to indications of the thermometer and barometer, direction of the wind, state of the weather, amount of rain and snow, character of clouds, occurrence of thunder-storms, fogs, frost and hail, earthquakes, auroras, etc.

From these observations the mean temperature of each day of each month is deduced and arranged in tables. The mean temperatures, however, require a small correction in order to reduce them to the mean temperature of the day which would be given from twenty-four or hourly observations instead of only three observations. In the discussion of the temperature the correction applied on account of the irregular hours was deduced from a series of observations taken at every hour of the twenty-four at Toronto and Montreal, which are found to have been subjected to the same fluctuation of temperature as Brunswick. To understand this, perhaps the following explanation is necessary: By adding all the temperatures observed at each hour of the day, for example all at 6 o'clock, into one sum, and dividing these by the whole number of observations at this hour, we obtain the average or mean temperature of that hour, and by repeating the process for every other hour we obtain a series for each hour of the twenty-four; also, by adding together all the average temperatures of each hour of the day and dividing by twenty-four, we obtain the mean temperature of the day. If the mean temperature of the day be compared with the mean temperature of each hour, some of the latter will be a little above and others a little below the former; and as these differences are found to be the same over a large extent of country, we may apply them to observations made at one, two, or three hours, so as to get the same result which would be obtained had the observations been made at every hour during the twenty-four. Thus it has been found, from several series of hourly observations in different parts of the United States, that those made at 7 a. m., 2 and 9 p. m., give a nearer approximation to the mean temperature of the day than those made at any other hours. We dwell somewhat on this point because the idea has been prevalent that the best times for determining the mean temperature are at sunrise, noon and sunset. But since sunrise and sunset are variable hours, it is obvious that corrections similar to those we have mentioned above cannot be readily applied to them.

The observations at Brunswick, having been duly corrected in the way we have mentioned, present, during a period of *fifty-two* years,

a mean temperature of 44° 4′ Fahrenheit, which reduced to the level of the sea becomes 44° 6′.

The lowest mean temperature for any year occurred in 1859, and was 40°.31, and the highest was in 1840, 51°.60, giving a range of 11°.29, which is considerably larger than at places farther south in the United States. A table is given of the fluctuations of the annual mean temperatures, which, with others of a similar character, is directly available for the study of the secular changes of the temperature; or, in other words, for ascertaining whether within the period of instrumental observations the annual temperature has undergone any sensible variation. No indications of this, however, have been found. On the contrary, it appears from the observations made between 1807 and 1832, inclusive, that the annual temperature was 44°.10, and between 1833 and 1859, inclusive, it was 44°.70, a difference readily accounted for from errors of observation and change of instruments, and too insignificant to substantiate a change in climate. It has been observed in other parts of the earth that the annual temperature undergoes a periodical change at certain seasons of the year, and in this country it has been supposed that a similar change occurs, viz., a cold period about the end of May, and a warm one in October. The discussion of the observations for 52 years does not indicate any such periodical fluctuation at these times.

According to the average of 52 years, the warmest day falls on the 22d of July, or 31 days after the summer solstice, and has a mean temperature of 67°.7.

The coldest day on an average is the 18th of January, or 28 days after the winter solstice, having a temperature of 19°.9 Fahrenheit. On an average, the 20th of April and the 24th October have the same temperature as the mean of the entire year. The lowest record for the whole time is 30° below zero, and the highest 102° above.

The northwest wind on an average reduces the temperature 4°.6. The north lowers it 3°.1, and the northeast 3°.8. The southwest wind, on the contrary, elevates the temperature above its normal value 2°.6. In summer the effect of rain and fog is to lower the temperature 6°.5. In winter, snow, sleet or rain increases the temperature 4°.3. From 54,097 observations, the following is the proportional number of winds in 1,000:

South.	North.	West.	East.	S.W.	N.E.	N.W.	S.E.
29	40	51	29	311	143	320	77

From this it results that the most frequent are the northwest and southwest, the former in winter and the latter in summer. The least number of days in which rain fell was in February, the greatest in May. The greatest number of days in which snow fell was in January. The earliest snow occurred on the 26th September, 1808, and the latest on the 8th of June, 1816. On an average, snow falls in Brunswick on some day in May once in five years, and in October once every other year. The average number of rainy days is 64. The average number of snowy days is 30. The average amount of rain and snow is 44.68 inches. The greatest amount of rain during any one day was $8\frac{1}{4}$ inches, November 4, 1845. The greatest fall of snow was on the 10th of March, 1819, and measured 30 inches. The greatest number of rainfalls occur while the wind is from the northeast, and the least number while it is from the west. The northeast wind in winter is almost constantly accompanied by rain or snow, while in summer the southeast surpasses it as a vehicle of rain, a result evidently due to the position of the place of observation with respect to the ocean. The number of storms of thunder and lightning recorded during 51 years is 472, or about 9 a year. The greatest number occurred in July and August, the least in January and February. The total number of fogs is 1,135, or 22 in a year, the most dense of which occur in summer, the least dense in winter.

July is the only month in which no frost is recorded. The earliest frost observed was August 3d, and the latest June 19th. On an average, the spring frost ceases after the first week in June, and the autumn frost commences after the first week in September. There were 34 hail storms—the greatest number in January, the least in August. The records notice the occurrence of seven earthquakes and 86 auroras, the greatest number of the latter in September and October.

The aurora also exhibits a maximum and a minimum. The maximum occurred in 1808, 1818, 1830, 1838, 1848, 1857, giving differences of 10, 12, 8, 10, and 9 years. This indicates an average period of about 10 years. Unfortunately the temperature of the barometer is not given, and therefore a reduction on account of the expansion of the mercury is not possible, and consequently the only use which has been made of the record has been to exhibit the monthly extreme values, together with their annual variations.

The barometric maxima reach their greatest value in December and their least value in June. The minima occur in August. The monthly range is the greatest at the period of greatest cold, in January, and the least range at the period of greatest heat, in July.

The observations at Marietta, Ohio, extend from 1817 to 1823, by Mr. Joseph Wood, and from 1826 to 1859, inclusive, by Dr. S. P. Hildreth, the whole presenting an almost unbroken series of 40 years. Marietta, the oldest town in the State of Ohio, is situated at the junction of the Muskingum and Ohio rivers, in latitude 39° 25′, longitude 81° 29′ west, about 580 feet above tide-water.

The registers embrace records of temperature, wind, pressure of the atmosphere, face of the sky, cloudiness, and precipitation in snow and rain. The observations of Mr. Wood were made at sunrise, 2 p. m. and sunset, and by Dr. Hildreth generally at 6 a. m., 2 and 9 p. m., in summer, and 7 a. m., 2 and 9 p. m., in winter. Deviations in both series from these hours are noted and corrections applied in the reductions.

Unfortunately a small portion of the manuscripts was lost by the fire which destroyed a part of the Smithsonian building in January, 1865. This loss was partly supplied by the monthly means which had been published by Dr. Hildreth in Silliman's Journal.

During the 40 Marietta years a mean temperature is shown of 52°.46. The mean temperature of 1828, the warmest year during the whole period, was 55°.38, and that of the coldest, 1856, was 49°.71, showing a range or variation of temperature of 5°.67, which is about the usual range of annual temperature, as indicated by shorter periods in our latitude. The discussion indicates no change of annual temperature during the whole period of 40 years, the mean temperature of the first 20 years being the same as of the last 20 years. Neither do these observations indicate any change in the temperature of summer or winter by comparing the first 20 with the second 20 years. We think it probable, however, that a full discussion of all the records collected by the Institution would show some slight change in the average temperature of summer and winter due to the exposure of the surface by the clearing away of trees, although no indications of a similar kind may be given in the mean temperature of the year.

The greatest fluctuation of temperature is in February, and the least in July and August. The lowest temperature during the whole period was 23 degrees below zero, Fahrenheit, at 7 o'clock a. m., January 20, 1852; the extreme highest 102 degrees at 3 p. m., July 14, 1859. These observations give an extreme range of temperature of 125 degrees, which, when compared with that of Europe, may be considered excessive; but, compared with that of other parts of America and Asia, is not unusual. From all the observations it appears that, on an average, the warmest day of the year is the 23d of July, and the coldest the 15th of January, while the days which have the

same temperature as the mean of the whole year are the 14th of April and the 15th of October.

The average temperatures of the seasons are as follows:

	°
Spring	52.88
Summer	71.51
Autumn	52.78
Winter	33.01

There have been observed by the meteorologists of Europe variations in the ordinary march of the change of temperature. Of these there is one about the beginning of December, and another about the middle of May, which are most conspicuous. The cause of such abnormal change of temperature must be either local or general; if the latter, its influence must be felt, perhaps, with some modification in all parts of the globe. The observations were examined in regard to these abnormal changes; but though they indicate a normal temperature about the beginning of December, they show a remarkable depression of temperature between the 25th and 28th of November, which is preceded by an elevation on the 22d. A similar depression, however, is not observed in the series for Brunswick.

The direction of the wind is recorded for 27 years to eight points of the compass, and the result as to the relative frequency of each in proportion to 1,000 is shown in the following table:

S.	N.	W.	E.	S.W.	N.E.	N.W.	S.E.
173	217	135	52	213	39	87	84

From this it appears that the majority of the winds are from the north and southwest, while the northeast and east winds are the least frequent. The south wind is more frequent in summer, and the west and northwest in winter. This differs slightly from the winds in Brunswick, Maine, where the wind of the greatest frequency is that from the northwest, and next from the southwest. The difference is probably due principally to the configuration of the surface.

The result of another investigation indicates an apparent secular change in the direction of the wind, similar to the one noted at Brunswick; but as the epochs are different, the subject requires the discussion of more extended observations at different places.

The discussion of the connection of the direction of the wind with

the temperature, from observations of 2,340 days, exhibits the fact that the warmest winds are from the southeast, south and southwest, all others being cold; the extreme difference being 15 degrees in winter and 8½ in summer. The comparison of the direction of the wind and rain shows that the southwest wind in summer and the southeast in winter are accompanied by the greatest amount of precipitation, and that fair weather generally attends northerly winds throughout the entire year. In summer the easterly and in winter the westerly winds are also attended with fair weather. The average annual quantity of rain and melted snow is 42½ inches; the least amount observed in any one year is 32°.46, and the greatest 61°.84, varying much less than is recorded of Brunswick. The greatest amount of rain in any one month is in June, and the least in January. The average number of rainy days in a year is 86. The quantity of rain is more equally distributed throughout the year than at Brunswick. The greatest fall of rain recorded on any one day was 4.25 inches, on the 3d July, 1844. The largest fall of snow, 15 inches, was on the 4th of December, 1833.

The indications of the barometer show a regular progression in the weight of the atmosphere, which attains its greatest value in January and its least between July and August.

Ethnology.—The subject of ethnology has, during the past year, continued to occupy a considerable share of the attention of the Institution. Renewed efforts have been made, by means of circulars and correspondence, to increase the collection of specimens illustrative of the different races of men inhabiting or who have inhabited this continent.

The very extensive collections of ethnological articles from almost every part of the world, made by the United States exploring expedition under Captain (now Admiral) Wilkes, having been placed in charge of the Institution, not only afford a basis for a comparison of the different modes of life and stages of advancement among existing tribes, but an important means of determining the ethnological relations of the natives of the present day to those whose ancient remains lie thickly strewn over our whole continent. For example, implements of stone and of bone are almost everywhere found, the workmanship of races that have long since disappeared, and of which the use would be difficult of determination, were not similar implements as to form and material found in actual use at the present day among savages, particularly those inhabiting the various islands of the Pacific ocean. Our object is to collect well-characterized specimens,

illustrative of the remains of ancient industry; first, for the formation of a collection as perfect as possible to be preserved in the national museum; and second, for duplicates to present to other institutions, with which we maintain relations of reciprocity. It may be observed that, in making exchanges of specimens, the object is not alone to enrich our museum, but to furnish the means throughout the world of a more comprehensive comparison, and consequently to facilitate the study of the various stages of the development of human invention.

During the past year large and valuable collections have been received from the northwest coast and from within the Arctic Circle, illustrative of the Indians and Esquimaux of these regions. We have been particularly desirous to awaken an interest in the exploration of the shell-heaps which have been found at various points along our coast. These are now known to be of an artificial character, and are frequently rich in specimens of the industry of the earlier inhabitants of this country. As to the archæological value of these shell-mounds, considerable difference of opinion prevails. They are even regarded by some as the work of known tribes of Indians, concerning whom we possess other and better sources of information; but, even if this be so, they would serve to illustrate peculiarities of customs, and should, in all cases, be explored and the materials found in them carefully preserved. From the specimens derived from the shell-deposits on the coast of Norway, the Scandinavian archæologists were enabled to divide the stages of civilization into three principal periods, namely: the stone age, the bronze or transition age, and the iron age. These divisions have been generally admitted as characteristic of the principal stages of human development, though they are not regarded as successive periods in the general advancement of the world, since the inhabitants of one country may be in the condition of the stone age, while those of others are in the full enjoyment of all the advantages of the iron epoch.

This division furnishes a ready means of classifying the various archæological objects, so as to exhibit the comparative civilization in different places at the same or at different epochs, and, though it may be superseded by a more philosophic classification, it forms an important step in the gradual advancement of a new science. Indeed, it has lately been proposed to divide the stone age into two—the palæolithic, or first stone age, and the neolithic, or second stone age; and from the discoveries which have been made of late, and which have been so cumulative, we can scarcely

question the conclusions to which they all seem to point, namely: that though the remains of man are found in a very recent geological period, yet, in a historical point of view, the antiquity of these remains is much greater than was formerly supposed. Those which belong to the palæolithic age are usually found in beds of gravel and loam, extending along river valleys and reaching a height sometimes of 200 feet above the present water level. That these beds were not deposited by the sea is proved by the fact that the remains which occur in them are those of fresh water, and not of marine animals. These deposits contain fragments of such rocks only as occur in the area drained by the river itself, and consequently at the time the deposit was formed the topography of western Europe could not have been very different from what it is at present. That the climate, however, was much more severe than it is now is shown by the character of the animals of which the bones are found in abundance, namely: the musk-ox, the woolly-haired rhinoceros, the lemming, and the reindeer—all arctic animals. The great antiquity of the period is inferred from several indications. The extinction of the large animals must have been a work of time, and neither in the earlier writings, nor in popular traditions, do we find any indication of their presence. Again the beds of gravel and loam, which in most cases are deposited in regular strata, would require a long succession of seasons, since we see how little effect is produced at the present time in the course of a number of years.

In these deposits mingled with the regular strata are found stone implements indicating the presence of reasoning beings previous to the time at which the strata were deposited. According to Sir John Lubbock, about 3,000 flint implements have been found in what he denominates the palæolithic age, in northern France and southern England, but no traces of pottery, nor evidence of the use of metals, nor even of polished stone implements, have yet been met with.

The neolithic age commences with a knowledge of a higher degree of art, at a period when polished axes, chisels, gouges, and other implements of stone, as well as hand-made pottery, were extensively used in western Europe. The objects peculiar to this period do not occur in the river drift gravel as in the previous period, except some of the simpler ones. The implements are remarkably numerous in Denmark and Sweden, while the palæolithic types are absolutely unknown there. It has hence been inferred that these northern countries were not inhabited by man during the earlier periods. The Danish shell-mounds belong to this period, as well as those of our own

country, and hence it becomes an important object of inquiry to determine whether any real types of the palæolithic age exist in North America. The two stone ages, however, are characterized by the use of stone or bone, to the exclusion of metal.

It is evident, from the specimens which have been collected, that there was a period when bronze was extensively used for arms and implements. This is particularly manifest in the examination of tumuli, in which stone and bronze implements are found existing together. Some of the bronze axes, in many cases, appear to be mere copies of those of stone, as indeed is the iron axe used by the pioneers in clearing the American forest.

The bronze age is also distinguished from the stone age by the bones of animals which are found mingled with the implements. Those of wild beasts prevail in the former, while those of tame beasts are most numerous in the latter. No articles of bronze have been found in this country, though those of copper, showing a less advance in art, are frequently found in ancient mounds.

The iron age appeared when the metal was first used for weapons and cutting instruments, and gradually extends into the twilight of history. From all the remains which have been found, it is evident that neither bronze nor stone implements were used in northern Europe at the commencement of the Christian era, and that the inhabitants of these regions were not as low in the scale of civilization as the accounts of their conquerors would seem to place them.

Exchanges.—The system of international scientific and literary exchanges, to facilitate the correspondence between learned institutions and individuals of the Old and New World, has been fully maintained during the past year, 1,083 boxes and packages having been sent out, and 782 received since the date of the last report, most of them with a large number of sub-parcels enclosed.

These packages, as in former years, contain the publications of institutions, public documents, transactions of societies, scientific works presented by individuals, specimens of natural history, ethnology, &c. This part of the operations of the establishment has found much favor with the public. "We have nothing of the kind," says a recent English publication, "in this country, and the difficulty in exchanging books and specimens is much felt. The comparative cheapness of freight is more than made up by the complicated agencies and other extra charges, which can scarcely be avoided even by those initiated in the secrets of the business. The sending one

or two volumes or a small packet of specimens into Germany is often prevented by the difficulties and expense attending it."

At stated periods the following circular is distributed to institutions and individuals in America :

"The Smithsonian Institution is now making preparations to send copies of its publications to the different libraries and societies in Europe and other parts of the world with which it is in correspondence. As in previous years, it will undertake the transmission and safe delivery of the publications of other American institutions on the following conditions :

"1st. The volumes or publications to be put up in compact packages, enveloped separately for each particular address. They must not be sealed, although they can be pasted up or tied. Unsealed letters relating to the contents of the package may be placed inside or sent separately. *In no case will sealed letters or packages be forwarded by the Institution.*

"2d. The packages must be addressed legibly, in full, (if German, they must be in Roman character,) and the name of the donor must be indorsed on each.

"3d. *The parcels must be delivered in Washington free of expense to the Smithsonian Institution.*

"4th. A detailed and full invoice of all the addresses on the parcels must be sent separately, in advance, by mail.

"5th. The parcels should conform as nearly as possible in length and breadth to the corresponding dimensions of the Smithsonian Contributions to Knowledge, if in quarto, or to half this size, if octavo. Octavo pamphlets should not be folded. No single package should exceed six inches in thickness.

"6th. No charge will be made for the expenses of sending from Washington, if the parcels be of moderate bulk. In any case the proportion of actual expenses will only be called for.

"If desired, the Smithsonian Institution will make the selection of the most suitable recipients of any publications. In this case nothing but the name of the donor need be marked on the parcels.

"The next transmission of packages from the Smithsonian Institution will take place about the 1st June.

"Parcels should be in hand a month earlier, and the lists sent by mail at the earliest possible moment. These will be wanted considerably in advance of the parcels, in order to make out the complete invoices for each different address before commencing to pack the boxes.

"Unless the above conditions are severally and strictly observed the parcels cannot be forwarded.

The cost of this system would far exceed the means of the Institution, were it not for important aid received from various parties interested in facilitating international intercourse and the promotion of friendly relations between distant parts of the civilized world. The liberal aid extended by the steamship and other lines, mentioned in previous reports, in carrying the boxes of the Smithson exchanges free of charge, has been continued, and several other lines have been added to the number in the course of the year. The names of this class of patrons of the Institution are given in the following list:

Pacific Mail Steamship Company, North German Lloyd Steamship Company, Hamburg American Steamship Company, General Trans-Atlantic Steamship Company, Inman Steamship Company, Cunard Steamship Company, Pacific Steam Navigation Company, Panama railroad, California and Mexico Steamship Company.

Important favors have also been conferred during the year by the Adams, the Harnden, and the Wells & Fargo Express Companies; Mr. S. Hubbard, of San Francisco, and Mr. George Hillier, of the New York custom-house.

As in previous years, the agents of the Institution are: Dr. Felix Flugel, in Leipsic; Mr. Gustave Bossange, in Paris; Mr. Wm. Wesley, in London; Mr. Fred Müller, in Amsterdam.

In view of the delays incident to the transmission of packages to Italy, the Institution has embraced a proposal from the Royal Institute of Milan, conveyed through the friendly intervention of the American minister, Hon. G. P. Marsh, to take charge of the exchanges with that country, and a number of boxes have accordingly been shipped to Milan, via Genoa, during the year.

Besides these agents, our countryman, Mr. James Swaim, now residing in Paris, has kindly consented to act as a special agent in superintending the construction of such articles of philosophical apparatus as the Institution may require.

During the session of 1866–'67 an act was passed by Congress providing for the reservation of fifty complete sets of all the works published at the expense of the United States, to be placed provisionally in the hands of the Joint Library Committee of Congress, in order to be exchanged, through the Smithsonian agency, for corresponding publications of other nations. The object in this was to secure regularly and systematically, at the least possible expense, all reports and

other documents relative to the legislation, jurisprudence, statistics, internal economy, technology, &c., of all nations, so as to place the material at the command of the committees and members of Congress, heads of bureaus, &c. No appropriation was made for meeting the necessary expenses, which, of course, could not be borne by the Smithsonian fund, since all the returns were to belong to the Library of Congress; but as a year would necessarily elapse before any documents would be ready for distribution, it was thought proper to defer further action until the present season. In the mean time, however, a circular was issued by the Institution with the view of ascertaining what governments would enter into the proposed arrangement, and already replies have been received from a large number, all embracing the opportunity offered of procuring the national publications of the United States, and proffering complete series of their own in return. Some of these, indeed, have already sent large packages of their works without awaiting further action on the part of our government. Among them, one large box of books from the government of Victoria, Australia, has been received and the contents deposited in the Congressional Library.

In view of the great importance of securing the foreign works in question, we regret to learn that a difficulty has arisen in reference to the fifty sets referred to. The Public Printer does not consider himself authorized to furnish them without further legislation, since the distribution of the regular edition is already directed by law, and he cannot supply the fifty sets in question unless the regular edition be increased by that number. The attention of the Library Committee has been called to this subject, and it is probable that they will give it due consideration, as well as that of an appropriation to meet the necessary expenses.

The following is a list of governments which have responded favorably to the proposed international exchanges of documents, &c.:

France, Belgium, Great Britain and Ireland, Switzerland, Spain, Costa Rica, Netherlands, Chile, Denmark, Argentine Confederation, United States of Colombia, Wurtemburg, Finland, Hamburg, Baden, Sweden.

At the suggestion of Hon. John Bigelow, late American minister to France, a request was made by the Institution that some of the principal publishers of school-books in this country would furnish copies of their elementary text-books, in order that these might be presented to Professor E. Laboulaye, of the College of France, for examination, with a view to the application of some of their peculiar features to

the purposes of instruction in his own country. The character of this distinguished professor, and his known admiration of American institutions, secured for this request the prompt and liberal response of several publishers, a list of whom, with the number of works contributed, is as follows:

Harper & Brothers,	New York	62 volumes.
A. S. Barnes & Co.,	"	26 volumes.
Oakley & Mason,	"	10 volumes.
C. Scribner,	"	3 volumes.
H. Cowperthwait & Co.,	Philadelphia	10 volumes.
U. Hunt & Son,	"	12 volumes.
E .C. & J. Biddle,	"	12 volumes.
A. S. Davis & Co.,	Boston	6 volumes.
Sargent, Wilson & Hinkle,	Cincinnati	33 volumes.

Professor Laboulaye, in acknowledging the receipt of these 174 volumes, says: "These books form the admiration of all who take an interest in education, and I hope that France will profit by this example. We have excellent things at home by which you in turn might profit, but we have seen nothing comparable to your readers, your object-lessons, your graphics, and your geographical series."

Explorations and Collections.—The system of explorations mentioned in the preceding reports has been continued as in previous years, with the co-operation, in some cases, of other institutions and of persons interested in special branches of natural history. The objects of these explorations are to collect information and illustrations of the natural history, the ethnology, meteorology, and physical geography of the various parts of the continent of North America. The organization of these expeditions has been specially in charge of Professor Baird, who has devoted, with his wonted zeal, a large amount of labor to the preparation of outfits and to the care and arrangement of the specimens obtained. We shall give an account of these several explorations under the names of the districts within which they have been prosecuted.

British and Russian America.—In previous reports a statement has been given relative to the scientific department of the expedition organized by the Western Union Telegraph Company, for the purpose of effecting an electric communication between the United States and Europe, across Behring's Straits, and we have now to express our regret that the enterprise has been abandoned. We have, too, to deplore the sudden death of Mr. Kennicott, the director of the natu-

ral history department of the expedition, which took place in May, 1866, at Nulato, on the lower Yukon. In this dispensation of Providence, science has lost an ardent and successful votary, and the Institution one of its most valued collaborators. It is to him that we owe our introduction to the most important sources of information relative to the fur countries, and it is principally through his exertions that the museum of the city of Chicago, of which he was the director, received its endowment and organization.

After the death of Mr. Kennicott, Mr. W. H. Dall succeeded him as chief of the scientific corps, and has since been occupied in exploring the Yukon river from Fort Yukon to its mouth. He is still engaged in this work, but will probably return in the autumn of 1868.

To the co-operation of Col. Bulkley, the chief of the survey, and of Messrs. Scammon, Ketchum, Fisher, Smith, and others mentioned in the list of donors to the collections, much of the success of the operations relative to natural history is due. The collections themselves were made principally by Messrs. Kennicott, Dall, Bischoff, Bannister, and Elliott. Since the return of the surveying parties all the maps and reports relating to the geographical part of the work have been placed in possession of this Institution, with a view to their being elaborated in the form of a memoir for publication.

The explorations under the auspices of the telegraph company were made partly in Nicaragua during the transit of the scientific corps across the Isthmus, partly in the vicinity of San Francisco while the expedition was in process of being organized, partly in Kamtschatka and in British Columbia, but chiefly in the island of Sitka and on Norton Sound and the Yukon river.

The collections from the Yukon and Norton Sound region, as well as those from both sides of Behring's Straits, are very extensive and valuable. Among the results most interesting to the naturalist is the discovery at Norton Sound and at Nulato of three genera of birds* previously supposed peculiar to the Old World.

The collections of the telegraph expedition at Sitka were made by Mr. Ferdinand Bischoff, during a stay of about fourteen months, and are of great extent and value. Desirous of having a collection of specimens from Kamtschatka for comparison with those from the shores of Russian America, the Institution, conjointly with the Chicago Academy of Sciences, engaged the services of Mr. Bischoff for that purpose, and furnished him with a complete outfit, while the Pacific Mail Steamship Company, in its usual spirit of liberality as regards

* Species of Budytes, Phyllopneuste, and Pyrrhula.

the interests of science, gave him a free passage to San Francisco. Thence he sailed, still free of expense, in one of the vessels of the Russian Telegraph Company, but no stop being made at Kamtschatka, he was obliged to proceed to Plover Bay, the telegraphic depot on the Asiatic side of the straits, where he failed not to make some interesting collections. Returning with the vessel to San Francisco in October, he was directed to proceed to Mazatlan, and there, under the direction of the valued correspondent of the Institution, Colonel Grayson, he is now engaged in prosecuting his researches, but intends to return in the spring and proceed to Kodiak, where he will probably remain for a year, collecting specimens and exploring the country. It is proper to mention that he was also provided with a free passage to Mazatlan, through the kindness of Mr. Halliday, on the vessels of the Mexican, Oregon, and California line.

It was known that the Institution had for several years been diligently engaged in gathering specimens and collecting information to illustrate the character of the northwest portion of the American continent, and consequently, when the question of the acquisition of Alaska by the United States came under discussion, it was to the Institution that reference was chiefly made by the State Department and the Senate for information in regard to the country. Two of our collaborators, then on a visit to the Institution, Mr. Henry Bannister, who had spent a year in Norton Sound, and Mr. Bischoff, who had passed the same length of time at Sitka, were called upon to give evidence before the Committee on Foreign Relations, and were, in effect, the only persons examined who were acquainted with the region from personal observation. Professor Baird also gave valuable information as to the zoology of the country, from the materials which had previously been collected by the Institution.

For the purpose of obtaining additional information relative to the new Territory of Alaska, an expedition was organized by the Treasury Department, under the charge of Captain W. A. Howard of the revenue service, and, at the request of the Secretary of the Treasury, instructions for research into the physical and natural history of the country were furnished by the Smithsonian Institution. The expedition left San Francisco on the revenue steamer Lincoln, under command of Captain T. W. White, during the summer of 1867, and spent several months in its explorations. It was accompanied by a special party from the Coast Survey under charge of Mr. George B. Davidson, who has since communicated a valuable memoir on the country to the Superintendent of the Coast Survey, which has been printed by Congress. Important collections in natural history and ethnology have

been supplied to the Institution by Captains Howard and White, and Mr. Davidson.

The officers of the Hudson's Bay Company, especially at posts in the Mackenzie river district, have continued during the past year to make contributions in the way of information and specimens. Prominent among these may be mentioned, as in previous years, Mr. R. McFarlane of Fort Anderson, to whom we are indebted for an almost exhaustive collection of materials from the Arctic coast; Messrs. James Lockhart, Strachan Jones, C. P. Gaudet, W. Brass, J. and A. Flett, R. McDonald, J. McDougall, and James Sibbiston. To Mr. B. R. Ross the Institution owes a valuable contribution from Hudson's bay, embracing the first specimens of a large bird, the *bernicla leucopsis*, known to have been found in North America. It is intended to embody the result of the observations of our correspondents in Arctic America in a memoir, which will form an interesting addition to the ethnology, natural history and physical geography of the country.

It may be said to the honor of the officers of the Hudson's Bay and Northwest Companies, that though secluded for years from civilized society, they manifest in general no want of interest in subjects which pertain to a wide range of human culture; and it may be claimed on the other hand for the Smithsonian Institution, that it has been not slightly efficient in enlivening their isolated and monotonous life by the incitements and facilities it has afforded them for the study and observation of the phenomena and objects of nature.

Mr. Donald Gunn, our veteran correspondent in the Red River settlement, has made, at our request, an expedition to the lakes west of Lake Winnipeg, and obtained some rare and valuable specimens not previously in our collection. An account of his journey is given in the appendix to this report, and will, we doubt not, be read with interest, if only as the production of a man who has spent his life far removed from the centres of refined civilization.

Among the collections received through the telegraph expedition was a valuable series of specimens gathered on the northern end of Vancouver's island by Mr. A. W. Heisen, an American resident, these being the first ever received from that region.

Western America.—Mr. J. G. Swan, of Neaah Bay, Washington Territory, whom we have mentioned as favoring the Institution with an interesting memoir on the Makah Indians, has continued his valuable contribution of marine animals and ethnological specimens. Extensive series of marine invertebrates and eggs of birds have been received from Dr. P. A. Canfield, of Monterey, and Dr. Cooper has furnished some rare eggs and nests. The remainder of a large col-

lection made by Dr. Coues in the vicinity of Prescott, Arizona, has also come to hand. Reports forming valuable contributions to the general natural history of the Territory have been published by Dr. Coues in the proceedings of the Philadelphia Academy of Natural Sciences, and in the American Naturalist, based on the specimens in the Smithsonian collection. Dr. E. Palmer, formerly associated with Dr. Coues in collecting in the vicinity of Prescott, and devoting himself while there especially to the plants and insects, has since spent some time in southern Arizona at Camp Grant, and procured copious collections in all branches of natural history, as well as full series of objects made or used by the Apache Indians, which he has presented to the Institution.

Interior mountain regions.—Dr. C. Wernigk has made explorations in Colorado and Montana, and presented specimens to the Institution for determination and addition to the collections.

During the summer of 1867, Dr. F. V. Hayden was engaged in a geological survey of Nebraska, under the direction of the Commissioner of the Land Office, and made extensive collections of fossils and other specimens, which Mr. Meek, of the Institution, is now engaged in determining. Dr. Minor, of the Winnebago reserve, has supplied many specimens of ethnology and zoology. To Mr. Allan Mudge and Dr. Crocker, of Kansas, we are also indebted for important contributions from the last-named State. During the past year an exploration of the geology of the region along the 40th parallel of latitude, and eastward from California, was authorized by Congress at the request of the War Department, and the expedition was placed by the Secretary of War under the charge of Mr. Clarence King, who, for several years, had been the assistant of Professor Whitney in the geological survey of California. On application by Mr. King, the Institution took charge of the preparation of the natural history outfit of the expedition, made arrangements to receive all its collections, and to give such necessary facilities for working up the results as are usually afforded to the scientific parties of the government. Besides the regular assistants, Mr. King is accompanied by Mr. Robert Ridgway as zoologist, and Mr. Bailey as botanist. The collections already received are of much interest. The labors of the survey have so far been devoted to the examination of the celebrated Comstock lode of Nevada.

Eastern and Southern States.—Collections of more or less extent have been received from various contributors east of the Mississippi river, which will be found detailed in the list of donations. Dr. H. B. Butcher has completed his explorations in the vicinity of Laredo,

Texas, and has furnished a series of specimens, of which the collection of birds is especially valuable as throwing light on the distribution of species.

West Indies.—In connection with explorations in the West Indies, the Smithsonian Institution has to deplore the loss of Dr. Henry Bryant, of Boston, one of its most highly prized coadjutors in the work of American explorations. Not alone did he freely contribute of his abundant means, but he gave his personal services indefatigably to the extension of knowledge in the field of natural history. In both these respects the Institution had enjoyed his uniform co-operation as it shared the fruits of his successful labors. These labors had been principally conducted in Labrador, and on the Gulf of St. Lawrence, in Florida, in the Bahamas, in Cuba, and in Jamaica; and it was while pursuing his researches in Porto Rico that he met with an untimely death, occasioned probably by excessive exertion in an insalubrious climate. He died 2d January, 1867, at the little village of Arecibo, in the last-named island. Dr. Bryant contemplated a memoir on the birds of the West Indies, and was, at the time of his death, engaged in the prosecution of this object. His entire collection of the birds of the West Indies has been intrusted to Prof. Baird for determination, and after this has been effected it is the design of Mrs. Bryant to present a series of each species to the principal museums at home and abroad, in conformity with the intention of her lamented husband.

From Jamaica collections have been sent by Mr. W. T. March, in continuation of many previous contributions, and from Cuba by Mr. Bishop. Mr. A. E. Younglove spent several months in Hayti, and obtained a valuable series of birds and reptiles, embracing several new species. Mr. E. M. Allen, United States consul at Bermuda, has also given attention to the birds and marine animals of the islands, and has sent specimens.

Towards the close of the year an appropriation was made for a special exploration relative to the geology of the island of Petite Anse, in the Gulf of Mexico, near Vermillion bay, and the adjoining region, by Professor E. W. Hilgard, of the University of Mississippi. The immediate inducement for this exploration was the discovery of a stratum of rock salt on this island, together with the remains of extinct animals associated with specimens of human industry. The exploration was commenced too late in the season to be fully prosecuted. The weather, however, proved unusually favorable, the sugar-cane having bloomed on the Louisiana coast for the first time in 27 years. The exploration suggested many new questions, which can only be

answered by further investigation. The following is an abstract of the results already obtained :

"The Port Hudson deposit described by Carpenter, Lyell, and others, is the cypress swamp equivalent of the 'bluff formation,' just as the existing cypress swamps correspond to the Mississippi alluvium. The three islands, (out of the chain of five,) which were examined, consist of outliers of 'orange sand,' which has resisted denudation; on and around which, strata precisely similar to those of Port Hudson have subsequently been deposited. The rock-salt of Petite Anse island underlies the orange sand, and is, therefore, anterior to the drift, and it may probably be reached at points much higher above tide level than has been supposed, obviating the chief difficulty (that of drainage) heretofore experienced in working the deposit, the lowest part of which only has thus far been explored. While the precise position of the deposit, as regards the inferior formations, cannot now be determined, the results of the boring of the New Orleans artesian well render the conclusion almost unavoidable, in view of the absence of all signs of disturbance on the coast, that the salt deposit is of an age corresponding to that of the strata penetrated in this boring, which there is reason to believe are post-tertiary. Apart from all these comparatively ancient deposits, the entire delta is underlaid at or near tide levels by a cypress swamp deposit, as it would seem, of later date ; and beneath these, as well as the more ancient deposits of a similar nature, there are beds of gravel of a composition similar to that of the main or Mississippi branch of the great stream of the orange sand epoch, which here appears to have divided into two branches, one reaching the gulf in the region of Vermillion bay, the other on or near the Sabine. Important information was obtained concerning the formations of northern Louisiana, which, while of course corresponding in general to those of Mississippi, differ so far as to promise a ready determination of the age of the grand gulf groups, which thus far remains in doubt, notwithstanding that those groups cover nearly half of the State of Mississippi, filling the space between the eocene and postpleiocene deposits. All that is known of it, is, that during its formation, palms flourished on the borders of an immense lake or everglade, which either bordered, or itself represented, the present gulf of Mexico. After what has been observed in Louisiana, there is less difficulty in accounting for the total absence of animal fossils from this formation in Mississippi." But the problem to be solved regarding its age, extent, and relations to the eocene and quaternary shores of the gulf is one of so much interest that while in Louisiana Mr. Hilgard was

impressed with the importance of a more extended exploration than was at first contemplated, which, starting from the northern border of the marine eocene, above Vicksburg, should proceed diagonally across to the locality where petroleum has been found on the borders of Texas. So great was the interest manifested in regard to these matters wherever he went in Louisiana, that, were the affairs of the country at all settled, he has no doubt it would be easy to procure an appropriation or even subscription for the purpose.

Mexico.—The regular correspondents of the Institution in this country have continued their co-operation. Colonel Grayson, of Mazatlan, has furnished specimens from the vicinity of that city, and from other points in Western Mexico. At the joint expense of the Smithsonian Institution and the Boston Society of Natural History, he visited, last spring, the island of Socorro, one of the Revilligideo group, some hundreds of miles southwest of Cape San Lucas, and made an exploration of its natural history, obtaining several new species of birds. Returning via San Blas, he met with a severe loss in that city by the death of his son, the companion of his scientific labors, who was murdered by some unknown persons. The result of Colonel Grayson's investigations will shortly be published in the proceedings of the Boston Society of Natural History.

Professor Sumichrast and Mr. Botteri, of Orizaba, and Dr. Sartorious, of Mirador, have continued their valuable contributions, the latter gentleman in addition furnishing meteorological records.

Central America.—The collaborators in this part of the continent still continue active. From Guatemala Mr. Henry Hague has sent large collections of birds and mammals, and Dr. Van Patten, of vertebrata generally. From Costa Rica, the contributions of Dr. A. Von Frantzius, Mr. Endres, José Zeledon, and Mr. Juan Cooper embrace ample series in certain branches of zoology, while Mr. F. Lehmann has furnished an interesting collection of fossils and minerals.

The last of the collections made in Yucatan by Dr. Arthur Schott, during the exploration of that country instituted by Governor Salazar, have reached the Institution, and with the first portions received, furnish an excellent idea of the natural history of the northern part of the peninsula, the southern part of which will be illustrated by Dr. Berendt's researches.

As mentioned in a preceding report, Dr. H. Berendt, who has been many years one of our collaborators, undertook an exploration of the little-known interior of the Peninsula of Yucatan, under the auspices of the Institution, and at the expense partly of subscriptions by various societies and individuals. He first passed up the

Balize river, and thence to the region about Lake Peten, where he remained until the summer of 1867, making collections in natural history, and prosecuting researches in anthropology and geography. He visited the United States towards the end of the year, but will return shortly to Guatemala to complete his labors and to bring back his extensive collections.

An important collection of antiquities has been presented by the Hon. C. N. Riotte, late United States minister to Costa Rica. Mr. Geo. N. Lawrence, of New York, a collaborator of the Institution, is at present occupied in preparing a catalogue of the birds of Costa Rica, based chiefly upon the Smithson collection, which will probably include 500 species. To Dr. Von Frantzius the acknowledgments of the Institution are especially due for his valuable scientific correspondence and intelligent aid and supervision in conducting the explorations of the Institution in his adopted country.

Mr. Hardiman, of San Salvador, has contributed the first collection of birds received from that country. Mr. Osbert Salvin has presented a series of the birds of Veragua, collected by his correspondent, Mr. Arcé. Dr. Kluge, of Aspinwall, and Captain J. M. Dow, of Panama, have also continued their aid. The services of the latter in attending to the interests of the Smithsonian Institution on the Isthmus of Panama and the west coast of Central America, in issuing supplies, receiving and forwarding collections, &c., are of great value, and deserve the special acknowledgments of the Board of Regents.

South America.—The principal exploration in South America under the auspices of the Institution has been that of Prof. James Orton, of Rochester University, undertaken especially in the interest of the Lyceum of Natural History of Williams College, Massachusetts. The Institution lent the scientific instruments, supplied a considerable portion of the outfit, and took charge of the transportation and reception of the collections. Two parties were organized. The one under the immediate direction of Prof. Orton proceeded to Guayaquil via Panama, the other under Mr. W. B. Gilbert went to Venezuela. The party under Prof. Orton, after remaining some time at Guayaquil, where most of them were taken sick with yellow fever, finally arrived at Quito. Here they had the misfortune to lose one of their members, Colonel Phineas Stanton, a gentleman of many accomplishments, who volunteered to accompany the expedition as an amateur artist. After exploring in Pechincha and other localities on the plateau of Ecuador, they crossed to the head-waters of the Amazon, descending by Marañon to Para, and thence returned home. The

Venezuela division prosecuted their researches for a time in the district of Caraccas, and then returned via the Orinoco river. All the collections of both parties have been sent to the Institution for identification, and have been distributed for that purpose among the naturalists of the country.

A collection principally of birds and butterflies, made in the neighborhood of Bogota, was conveyed to the Institution through the attentive care of Hon. A. A. Burton, late United States minister. Many of the species are new as regards that locality. From Chile there has been received a collection, nearly complete, of birds prepared and determined by Prof. A. R. Phillippi, Director of the National Museum at Santiago. The series is of special value as containing types of many of the new species described by Prof. Phillippi and his associate, Dr. Landbeck.

An important Smithsonian exploration has been made during the last year in the Province of Buenos Ayres by Mr. W. H. Hudson, who has transmitted large collections of birds, which have been referred to Mr. P. L. Sclater and Mr. Osbert Salvin, of London, for examination, these gentlemen having been especially occupied in the study of South American birds. Mr. A. de Lacerda, of Bahia, has continued his valued contributions from that portion of Brazil.

With the exception of the Russian telegraph expedition at Plover bay, and on the Asiatic side of Behring's straits, the explorations we have enumerated have been confined to the American continent and its islands. This is in accordance with a settled policy of the Institution, to the effect that the natural and physical history of the Old World shall be relinquished to the explorers of Europe.

The following remarks by George Bentham, esq., president of the Linnean Society of London, present the scientific importance of explorations in this country in so clear a light that I may be excused for quoting them at length: "The peculiar condition of the North American continent requires imperatively that its physical and biological statistics should be accurately collected and authentically recorded, and that this should be speedily done. Vast tracts of land are still in what may be called almost a primitive state, unmodified by the effects of civilization, uninhabited, or tenanted only by the remnants of ancient tribes, whose unsettled life never exercised much influence over the natural productions of the country. But this state of things is rapidly passing away; the invasion and steady progress of a civilized population, while changing generally the face of nature, is obliterating many of the evidences of a former state of things. The larger races of wild

animals are dwindling down, like the aboriginal inhabitants, under the deadly influence of civilized man. Myriads of the lower orders of animal life, as well as of plants, disappear with the destruction of forests, the drainage of swamps, and the gradual spread of cultivation, and their places are occupied by foreign invaders. Other races, no doubt, without actually disappearing, undergo a gradual change under the new order of things, which, if perceptible only in the course of successive generations, require so much the more for future proof an accurate record of their state in the still unsettled condition of the country. In the Old World almost every attempt to compare the present state of vegetation or animal life with that which existed in uncivilized times is in a great measure frustrated by the absolute want of evidence as to that former state ; but in North America the change is going forward, as it were, close under the eye of the observer. This consideration may one day give great value to the reports of the naturalists sent by the government, as we have seen, at the instance of the Smithsonian Institution and other promoters of science, to accompany the surveys of new territories."

The total number of contributors to the collections of the Institution in 1867 was 163. The total number of primary boxes or packages received was 320. The general character of these additions will be learned from the table at the end of the report; they vary from single specimens to boxes filled with a variety of objects, the latter being far the most numerous. Among the most important may be mentioned the collections of the Russian telegraph expedition, those of Dr. Butcher, of Mr. Carmiol, of Colonel Grayson, of Professor Sumichrast, of Dr. Hayden, of Mr. Hudson, and of Dr. Palmer.

To the Zoological Garden of Hamburg, Dr. W. H. Sigel, director, the Institution is indebted for the present of a number of European house sparrows, which had been asked for with the view of naturalizing them in Washington and vicinity, in order to secure the aid of these nimble and voracious birds in ridding the fruit and shade trees of this region from noxious insects. Although 300 were embarked, only five reached the Institution (in August last) alive. These were immediately liberated and have remained in the proximity of the building during the winter. For further notice of these sparrows see general correspondence.

The Institution is indebted to Mr. T. A. Randall, of Warren, Pa., for a large number of living *menopoma allegheniensis* from the Allegheny river. Such of these as survived were sent to several of the Zoological Gardens of Europe, and others will probably be transmitted in the ensuing spring.

Investigations.—As in previous years, the natural history material collected by the Smithsonian Institution has been freely distributed to special investigators for examination and description, among whom are the following:

Thomas Bland, New York; univalve shells from Mexico and Bogota. D. E. R. Beadle, Philadelphia; shells of various portions of the globe. Dr. T. M. Brewer, Boston; nests and eggs of North American birds, to be included in Part 2, North American Oology. Dr. P. P. Carpenter, Montreal; mounted chitons and British shells, shells of Puget Sound, Santa Barbara, California, and Nicaragua. John Cassin, Philadelphia; all the *Icteridæ*, *Rhamphastidæ*, and *Trogonidæ* of the Smithsonian collection, for monographing; birds collected in Ecuador, and on the Upper Amazon. Professor E. D. Cope, Philadelphia; reptiles from Mexico, New Grenada, Navassa, Vancouver island, Sitka, &c.; entire Smithsonian collection of salamanders for a monograph; recent and fossil bones of cetaceans and saurians. Dr. Elliot Coues, U. S. A., Columbia, S. C.; entire Smithsonian collection of *alcidæ* for a monograph. Thomas Davidson, London; types of fossils for comparison. W. H. Edwards, Newburgh, N. Y.; lepidoptera of Mexico, Colombia, and western North America. D. G. Elliot, New York; North American birds to be figured in his work on Birds of America. Professor T. Egleston, New York; specimens of minerals from various parts of the world. John Gould, London; types of new and rare species of humming birds, described by Mr. Lawrence, from the collection of the Smithsonian Institution. George N. Lawrence, New York; various collections of humming birds, and general collections of birds of Costa Rica, Bogota, and western Mexico. Isaac Lea, Philadelphia; unionidæ from various portions of North America. Dr. Joseph Leidy, Philadelphia; fossil remains of vertebrata from Colorado, &c. F. B. Meek, Washington; invertebrate fossils, from Nebraska, &c. Lewis H. Morgan, New York; skulls of American and European beaver. Baron R. Ostensacken; diptera of Mexico, &c., insect galls from Plover bay, Northeast Siberia. Tryon Reakirt, Philadelphia; lepidoptera of Colombia. Dr. I. T. Rothrock; plants collected in Russian America. S. H. Scudder, Boston; orthoptera of Mexico and other parts of North America. Dr. W. Stimpson, Chicago; marine invertebrata collected by Ferd. Bischoff, W. H. Dall and others, on the northwest coast of North America. Dr. P. L. Sclater, London; collection of birds made about Conelutas, Buenos Ayres, by W. H. Hudson. Dr. John Torrey, New York; collections of plants of various parts of the world. P. R. Uhler, Baltimore; hemiptera of Mexico and America generally. Dr. H. C. Wood, jr.,

Philadelphia; general collections of myriapoda. Professor Jeffries Wyman, Cambridge; skulls of Pacific coast Indians. The *insects* have been sent to the Entomological Society of Philadelphia to be identified and preserved.

Professor Baird has continued, as other duties would permit, his investigations in regard to the birds of America, of which 450 pages have already been printed, under the title of "Review of American Birds in the Museum of the Smithsonian Institution." The object of this work is to define the absolute and comparative characters of the birds of America, and especially to trace with minute detail their distribution during the breeding season, and the extent and character of their migrations. He has also been engaged in digesting and collating for publication by the Institution the mass of original notes contributed by Mr. Kennicott, Mr. MacFarlane, Mr. Ross, and others, relative to the natural history of the regions north of the United States, which are believed to embody much original information.

The records of the Institution have also been largely drawn upon for materials required by part 2 of the North American Oology of Dr. Brewer. As explained in previous reports, the object of this work also is to present, in addition to the description of the nests and eggs of the species, a complete account of their habits and geographical distribution during the breeding season.

For the promotion of these objects, circulars and pamphlets containing the necessary instruction to collectors have been issued for several years past, and large returns obtained, which will greatly extend our present knowledge. The notes containing information attached to the specimens received by the Institution have been carefully transcribed, and systematically arranged, so as to supply conveniently any information required on the subjects referred to.

In all cases in which specimens have been presented or lent to investigators for facilitating their researches, or enabling them to pursue certain lines of investigation, it is required that full credit for the favor conferred, as far as the facts may justify it, shall be given to the Institution by the authors in their resulting publications. In most cases this recognition has been fully complied with, but in a few we are sorry to say the acknowledgments have not been of the character or extent to which the Institution was entitled.

The distribution of the duplicate specimens of the collections has been carried on as rapidly as practicable during the year. The most important series sent off have consisted of skins and eggs of arctic birds, skins of mammals, shells, minerals, and ethnological specimens. The

minerals were arranged and labelled for the purpose by Professor Egleston, the shells by Dr. P. P. Carpenter, the ethnological objects by Dr. E. Foreman. As the collections generally become reduced to order, identified, and duplicates eliminated, further distributions will will take place. According to the account of Professor Baird, nearly a quarter of a million of different specimens have thus been sent away to places where they are likely to be of use. It should be borne in mind that in nearly every instance these specimens had previously been identified and labelled by the highest authorities, and in fact served as types or standards of special reference.

The foregoing account of the disposition of the specimens collected by the Institution will serve to illustrate the spirit and policy of the establishment, as well as the working of the system of active operations in its relation to the advancement of natural history. The same policy, but with more efficiency, would be continued, were Congress to take charge of the museum, or make separate provision for its maintenance.

Besides the investigations in the line of natural history, several others have been commenced, at the charge and under the direction of the Institution and are still in progress. George Gibbs, esq., has been engaged in collating and arranging for publication all the Indian vocabularies which have been collected by the Institution. An appropriation has been made for a systematic exploration of mounds and ancient remains in certain localities, of which an account will be given in the next report. As is seen under the head of meteorology, the labors of Mr. Schott have been continued in the reduction and discussion of observations. An appropriation has been made to assist Prof. Wm. Ferrel in a series of investigations relative to the tides; and another to Prof. Newcomb, of the National Observatory, to defray the expense of numerical calculations for his discussion of the observations of the planet Neptune. The Secretary, in connection with General Poe, of the Light-house Board, devoted a part of his summer vacation to investigations in regard to the penetration of sound, in its relation to fog-signals. The remainder of the same vacation, as well as a considerable amount of other time, was devoted to the examination of subjects referred to him by the government, as presiding officer of the National Academy of Sciences.

In addition to the collaborators in natural history already mentioned, the Institution during the past year has been favored with the gratuitous services of a number of other gentlemen in reporting upon questions proposed for solution, in examining memoirs, and in the preparation of articles for the report. Among these may be mentioned Prof.

G. J. Brush, of Yale College; Dr. Gray, of Harvard; Profs. Newcomb and Harkness, of the Naval Observatory; Drs. Woodward and Craig, of the Surgeon General's Office; Prof. Schaeffer and Mr. Taylor, of the Patent Office; Mr. Gibbs, of Washington; Mr. C. Rau, of New York; Prof. Chace, of Brown University.

National Museum.—Much time has necessarily been consumed during the past year in repairing the damage sustained by the specimens and the gallery of exhibition in consequence of the conflagration of the upper part of the building in 1865. The defective state of the temporary roof permitted a large amount of moisture to enter the walls, which kept the hall in a constant state of dampness, covering the specimens with mould. The entire collection has, however, been examined, dried, and cleaned; the shelves and the interior of the cases, with the stands of the specimens, whitened; the ceilings and walls frescoed, and new paint applied to most of the woodwork.

The most important work connected with the museum has been the labelling and preliminary arrangement of the extensive collection of ethnological objects, and the separation of the duplicates. All the collections of vertebrata as received have been catalogued and put in place; many osteological specimens cleaned; bottles of alcoholic specimens washed, &c. The labelling and registering of the collection has been continued as rapidly as possible, 13,221 entries having been made during the year.

This museum is principally made up of the type specimens of the collections made by the various expeditions organized by the government, as well as those projected and supported by the Smithsonian Institution itself, and owes but little to donations, and still less to purchases. There is, however, a large debt due the Institution from foreign museums, in the way of exchange, which we have no doubt will be cheerfully discharged as soon as they are informed that Congress has made provision for the support of a museum on a more extended scale than that which the Smithsonian is able to maintain. Besides the increase of the museum from the addition of type specimens derived from the various collections examined and described during the year, a number of foreign donations have been received, among which are specimens of the products of the iron mines and manufactures of Sweden, presented by Hon. G. V. Fox, late Assistant Secretary of the Navy, and from the same donor large and beautiful specimens of graphite from eastern Siberia, both rough and wrought, as well as exemplifications of the rocks associated with it.

It may be recollected that when the government museum was transferred to the Institution, it was stipulated that an appropriation

should be annually made for it in this new depository, equivalent to the cost of its support while in the Patent Office; and the appropriation for this purpose had been limited until the last session of Congress to the sum of $4,000. But this sum, on account of the rapid increase of the collections and the great advance in prices, is not now nearly sufficient even for the preservation of the specimens, to say nothing of the equitable claim which the Institution might rightfully advance for interest on the money which it has expended in providing the accommodations for this museum. It is but just to say that, in view of the peculiar condition of our affairs, the appropriation was, last year, temporarily increased to $10,000; but even were this continued, it would be still quite inadequate to the suitable maintenance of a national museum.

National Library.—The transfer of the library of the Institution to the care of Congress, authorized in 1866, was completed during the last year. The reasons for making this transfer were given in full in the last report, but it may be proper briefly to recapitulate some of the leading points.

First. The collection and support of a large library is not in strict conformity with the will of Smithson, as now generally interpreted.

Second. The whole of the income would in time not be more than sufficient to meet the wants of a rapidly growing library, the tendency being to absorb more and more of the funds with the increase of the number of the books, and hence even a library adequate to the wants of the various departments of government can only be properly supported by the appropriations of Congress. The government has already commenced such a library, and even if there were no objections to expending the income of the bequest of Smithson in the purchase of books and the maintenance of a library, it would be unnecessary to establish two libraries in such close proximity.

Third. By combining the two libraries in one, the expense of accommodation, of care and of management will be much diminished, and a greater facility as to consulting the works afforded.

Fourth. The portion of the Smithsonian building in which the library was deposited is not fire-proof, and was filled to overflowing, while further accommodations and protection could not be afforded without encroachment on the funds which had been set apart as the permanent capital.

Fifth. By the terms of the transfer, the cataloguing, binding, and entire care and management of the books are at the expense of the

government, and consequently an important portion of the income is made available for active operations.

Sixth. The transfer has furthermore tended to awaken an interest in the library of Congress, which cannot fail to render it, under the energetic superintendence of the librarian, Mr. Spofford, worthy of the nation. At the last session of Congress an appropriation of $100,000 was made for the purchase of the library of Mr. Peter Force, consisting of books relating to America, and with these additions the library of Congress is the largest in the United States,* and may even now with propriety be denominated, as we have ventured to call it, the National Library.

By the law authorizing the transfer, the Institution is at liberty to draw any books it may require for its use either from its own collection or from those of Congress. It is proposed, as soon as the regents' room is properly provided with cases, to keep in the Institution such books as are most frequently required for consultation in its operations, and fortunately a considerable number of these are duplicates in the two libraries.

Seventh. The books transferred to the National Library are in many cases such as could not be obtained by purchase, and are presents to the Institution from the old libraries of Europe, consisting of transactions and other publications of learned societies, forming a special collection not only ranking first in this country, but one of the best in the world.

Neither is it the value of the books already transferred which is to be considered, but also the perpetual increase of the several series of scientific transactions in their continuations from year to year which are regularly supplied in exchange for the publications of the Institution.

The collections of transactions of societies contain the record of the actual progress of the world in all that essentially pertains to the mental and physical development of the human family, and as it has been the aim of the Smithsonian Institution from the first to establish exchanges with all societies of this character, the list of those now in the national library includes, with scarcely any important exception, the whole series of the world, and affords the means therefore of tracing the history of at least every branch of positive science since the days of the revival of letters until the present time.

The use of this library for the purpose of research will soon be much facilitated and its treasures brought more generally into requi-

* In January, 1868, it contained 165,467 volumes.

sition by the publication of the classified index of all the physical papers in the transactions of learned societies and in scientific periodicals which has been in course of preparation for the last ten years by the Royal Society of London, and of which the printing of the first volume has just been completed. It may be recollected that the preparation of this index resulted from a letter addressed to the British Association in 1855, by the Secretary of this Institution, setting forth the advantages to science of such a work, that the matter was referred to a committee of the Association, reported favorably upon, and recommended for execution to the Royal Society. As soon as this work is published copies will be procured by the principal libraries and institutions in this country. Any person, then, desiring to investigate a special point in any branch of science, will be able to find a reference to the transactions, journals or proceedings in which it is contained; and as the most perfect set of these is to be found in the National Library, it will become a centre of information on scientific subjects. It may also be remarked that the National Library is now accessible to all persons during every week-day in the year, with the exception of one month devoted to cleaning and arranging.

In the arrangement of the compound library the principal part of the Smithson collection, that is, the scientific transactions, will form a department by itself in which works of a similar character previously belonging to the library of Congress will be incorporated, while the miscellaneous books of the Institution will be arranged with the works of a similar class already in that library. A complete catalogue of all the transactions belonging to the Smithson library up to 1866 was prepared and published by the Institution, and a general catalogue of the whole National Library is now in the press, in which the books of the Institution are designated by the letter—S.

Some idea may be formed of the value of the annual contributions from the exchanges of the Institution, when it is mentioned that it includes the publications of 1,081 societies, besides large donations from governments, libraries, and individuals, and that these publications are principally of a very expensive character, illustrated by costly engravings and in many cases by colored plates. The following is a statement of the number of establishments in different parts of the world which have contributed to the Smithson library, and which it is expected will continue their contributions from year to year for an indefinite period.

Number of societies sending their publications in exchange to the Smithsonian Institution.

Germany	334	East Indies	4
Great Britain and Ireland	194	Chile	4
France	113	Portugal	3
United States	100	Turkey	3
Italy	70	Mauritius	2
Holland	48	Africa	2
Russia	46	China	2
Switzerland	35	Brazil	2
Canada	20	Greece	1
Belgium	19	Egypt	1
Australia	15	Bogota	1
Denmark	13	Buenos Ayres	1
Sweden	12	Jamaica	1
Hindostan	11	Mexico	1
Norway	9	Trinidad	1
Spain	7		
Cuba	6	Making in all	1,081

To the list of correspondents during the past year we may add the Institute of Egypt, founded at Alexandria, in 1859, from which we have received the first volume of its transactions and several numbers of its proceedings. These works form, as it were, an epoch in the history of modern civilization, which, originally cradled in the valley of the Nile, now returns, after having changed the condition of western Europe, to the place of its birth, destined, we trust, to rouse from its long apathy "the country in which Pythagoras courted wisdom and Herodotus unveiled the sources of history." A library and collections have been formed, which are rapidly increasing, and which even now it is stated are capable of rendering essential service to the explorers of the valley of the Nile. Although the French language has been adopted for the reports and also for correspondence between the members of the society and the learned institutions of the west and east, yet the contributions of authors are presented in their original form and style, and hence the present volume includes memoirs in French, Italian, Greek, and Arabic, with illustrations in the hieroglyphic, Coptic, and Hebrew. To some of these memoirs, explanations, rather than strict translations, are appended.

The following is a statement of the books, maps and charts received by exchange, in 1867, and deposited in the National Library:

Volumes:		
Octavo	1,088	
Quarto	383	
Folio	86	
		1,557
Parts of volumes and pamphlets:		
Octavo	2,689	
Quarto	1,057	
Folio	200	
		3,946
Maps and charts		328
Total receipts		5,831

Among the more interesting additions to the library during the year is the work of Dr. Hochstetter, on New Zealand. This gentleman was one of the scientific corps of the celebrated Austrian exploring expedition on board the Novara, and when the vessel arrived in New Zealand, he was left, at the request of the governor of the colony, to make a geological exploration of the islands. The results of his labors are embodied in a special work, which conveys a great amount of information relative to the geography and natural history of the country. Originally published in the German language, an English translation has appeared in Stuttgardt, made by Mr. Edward Sauter, of Little Rock, Arkansas, to whom we are indebted for a copy of the work.

But perhaps the most valuable donation received during the past year is that from Hon. G. V. Fox, late Assistant Secretary of the Navy, through the Department of State. It consists of articles presented to him on the occasion of his recent visit to Russia as the bearer to the Emperor of a resolution of Congress congratulating his Majesty on his escape from assassination. They embrace 179 volumes, finely bound, many in quarto and large octavo ; 15 atlases and albums, some "eagle," others "elephant" folio size, all bound in cloth or morocco ; 72 maps, some in covers and cases ; 4 city plans, in cases, and 12 pamphlets—making in all 283 pieces, illustrating the physical geography, ethnology, and resources of the Russian empire. The character of this gift will be properly appreciat d when it is stated that, by a joint resolution of Congress, Mr. Fox was author-

ized to accept these books as additions to his own library, but, with commendable liberality, he has presented them to the Smithsonian Institution, to form part of the collections deposited in the National Library. They are principally in the French and Russian languages, and we have availed ourselves of the services of Mr. H. H. Kalusowski, of the Treasury Department, for the means of access to a knowledge of their rich contents.

The following are also some of the larger donations received in 1867:

Riksbiblioteket, Stockholm, 44 volumes.

Bergeurk Museum, Bergen, Norway, 8 volumes and 7 pamphlets.

Imperial Academy of Sciences, St. Petersburg, 11 volumes and 16 pamphlets, completing some of the early series of their publications.

Hydrographical Department of the Ministry of Marine, St. Petersburg, 38 volumes, 7 pamphlets, and 174 charts.

Imperial Free Economical Society, St. Petersburg, 12 volumes "Transactions."

Finland Society of Sciences, Helsingfors, 13 volumes.

Imperial Geographical Society, St. Petersburg, 16 volumes and 33 pamphlets.

Verein zur Beförderung des Gewerbfleisses in Preussen, Berlin, 40 volumes and 2 pamphlets, nearly completing the "Verhandlungen."

Kais. Akademie der Wissenschaften, Vienna, 13 volumes and 33 pamphlets.

K. Statistisch-Central-Commission, Vienna, 37 volumes and 60 pamphlets.

R. Istituto Lombardo di Scienze, Lettere ed Arti, Milan, 15 volumes and 27 pamphlets.

Ministero di Agricoltura, Industria e Commercio, Florence, 10 volumes and 2 pamphlets.

R. Istituto d' Incorragiamento alle Scienze Naturale, Economiche e Technologiche, Naples, 17 volumes and 23 pamphlets.

British Archæological Association, 16 volumes and 9 pamphlets, nearly completing the "Journal."

British Museum, 9 volumes.

Museum of Practical Geology and Geological Survey, London, 10 volumes and 19 pamphlets.

Institut Egyptien, Alexandria, the first volume of transactions and 9 numbers of bulletin.

Mining Department, Melbourne, 12 volumes and 17 pamphlets.

Real Sociedad Economico de Amijos del Pais, Habana, 256 volumes, chiefly theological.

American Board of Commissioners for Foreign Affairs, Boston, 36 volumes and 53 pamphlets.

Massachusetts State Board of Agriculture, 13 volumes and 7 pamphlets.

J. G. Cotta, Augsburg, 15 volumes.

Dr. Karl Koch, Berlin, 205 pamphlets.

Justus Perthes, Gotha, 12 volumes and 16 pamphlets.

F. A. Brockhaus, Leipzig, 13 volumes and 6 pamphlets.

Before concluding the history of the Institution for 1867, it becomes my duty to recall a painful event, which was announced to the Board at its meeting in February last. I allude to the death of Alexander Dallas Bache, the head of the United States Coast Survey, and one of the original members of the Board of Regents. On the occasion of the announcement of this bereavement, which was received with emotions of profound sorrow, the following resolutions, presented by Hon. J. W. Patterson, of New Hampshire, were unanimously adopted :

"*Resolved*, That the highest honor is due to the memory of our respected and beloved associate, Professor ALEXANDER DALLAS BACHE, who, through so many years of active life, has devoted, unselfishly and with untiring energy, great talents, profound acquirements and undeviating integrity to the advance of art, science, education and philanthropy.

"*Resolved*, That in the death of our lamented associate this Institution, of which he was a regent, and one of the executive committee from its first organization to the time of his death, has lost an efficient collaborator, a sagacious counsellor and zealous supporter.

"*Resolved*, That the members of the Board, in common with the Secretary, lament in his departure the loss of a warm and tried personal friend, and that they will always cherish the memory of his genial and sympathetic disposition, his gentle and prepossessing manners, his refined taste, high moral perceptions and unswerving advocacy of the right.

"*Resolved*, That a copy of these resolutions be transmitted to the widow of the deceased, and that the Secretary prepare a suitable eulogy for insertion in the next annual report."

In compliance with the resolution of the board, I have collected materials for a memoir of my lamented friend, Dr. Bache, and prepared as full an account of his life and labors as my time and ability would permit. The duty thus devolved upon me would have been accepted with alacrity as a means of gratifying my feelings of regard

and veneration had it not been associated in my mind, from the first, with a sense of its difficulty and responsibility. I was aware that it was not enough to narrate the events of his life, and to give a recital of his numerous and diversified labors; but that it would also be necessary to analyze his mental and moral constitution, as well as to trace the influence which his career has had, and will continue to have, on the advancement of science and education in this country. To fulfil this satisfactorily, though a duty not to be declined, is a labor requiring much care, and involving much solicitude. The sketch which I have prepared has been sent to Gen. Sabine for insertion in the proceedings of the Royal Society of London, and in view of my other pressing duties, it will be difficult for me to present the complete eulogy to the board at its present session. I therefore crave the indulgence of being allowed to defer the publication until the appearance of the report for 1868.

Respectfully submitted:

JOSEPH HENRY,
Secretary Smithsonian Institution.

WASHINGTON, *January*, 1868.

APPENDIX TO THE REPORT OF THE SECRETARY.

FROM THE REPORT OF PROF. S. F. BAIRD.

A.—*Table showing the statistics of the Smithsonian exchanges in* 1867.

Agent and country.	Number of addresses.	Number of packages.	Number of boxes.	Bulk of boxes in cubic feet.	Weight of boxes in lbs.
Dr. FELIX FLÜGEL, *Leipsic*—					
Russia	49	70	.....	.....	.....
Germany	336	395	.....	.....	.....
Switzerland	35	42	.....	.....	.....
Total	420	507	46	443	10,835
FREDERICK MÜLLER, *Amsterdam*—					
Sweden	13	22	.....	.....	.....
Norway	6	8	.....	.....	.....
Denmark	14	20	.....	.....	.....
Iceland	1	1	.....	.....	.....
Holland	51	68	.....	.....	.....
Belgium	19	21	.....	.....	.....
Total	104	140	15	146	2,780
G. BOSSANGE, *Paris*—					
France	113	122	.....	.....	.....
Spain	7	7	.....	.....	.....
Portugal	3	4	.....	.....	.....
Total	123	133	8	90	2,188
I. R. ISTITUTO, *Milan*—					
Italy	70	79	5	35	1,020
W. WESLEY, *London*—					
Great Britain and Ireland	197	230	24	186	4,200
Rest of world	87	101	15	75	1,500
Total	1,001	1,190	113	975	22,523

B.—*Packages received by the Smithsonian Institution from parties in America for foreign distribution in* 1867.

	No. of pkgs.
Albany, N. Y.—	
Albany Institute	16
Dudley Observatory	7
New York State Agricultural Society	55
New York State Homœopathic Society	6
Secretary of state	12

Appendix to Secretary's Report, 1867, p. 72 — gives Table showing Entries in record-books, Distribution of duplicates, Additions to collections, [illegible] donations and other [illegible] of Specimens [illegible]

REPORT OF THE SECRETARY

OF THE

SMITHSONIAN INSTITUTION

FOR THE

YEAR 1868.

WASHINGTON:
SMITHSONIAN INSTITUTION.
NOV., 1869.

REPORT

OF

PROFESSOR HENRY, SECRETARY OF THE SMITHSONIAN INSTITUTION,

FOR

1868.

To the Board of Regents:

GENTLEMEN: Nothing has occurred during the past year of a character demanding the special action of the Board. Indeed, the policy of the Institution originally adopted has become so firmly settled and so widely known, as well as properly appreciated, that few difficulties are now likely to present themselves in the administration of the trust which do not find a solution in some precedent in the experience of the past. The funds appropriated at the last session have been devoted to the different objects for which they were designated, and the several classes of operations which were inaugurated at the commencement of the Institution have been prosecuted with as much efficiency as the means at disposal would permit. From the first there has been no want of unoccupied fields inviting attention, and well adapted with judicious cultivation to yield a plentiful harvest of additions to science. Indeed, the only subject of regret suggested by a review of the past, or a survey of the present, is the application of so large a portion of the income to objects which, though in most cases important in themselves, are not, as is now generally conceded, strictly reconcilable either with the scope or the terms of the endowment. The guardians of the Institution are not, however, responsible for these expenditures, which had their origin in a general misconception of the import of the bequest at the time when Congress enacted the law organizing the Institution. On the contrary, the administration has been such as to correct, as far as possible, the errors above mentioned, and to present to the world an example worthy of imitation in the management of other establishments founded on trust funds. The directors have ever been deeply impressed with a sense of the importance of the trust committed to their charge, not only in consideration of the good which might directly result from it, but also on account of the influence which so conspicuous, and in many respects so original an enterprise, could not fail to have upon the world. Man is an imitative being, and among the many individuals in this country who have accumulated princely fortunes

by the energetic exercise of native talents, there are probably not a few who only need the assurance of a successful precedent to induce them to emulate the liberality of Smithson in the endowment of other institutions for the advancement of knowledge.

At the last session of the board it was resolved that a memorial should be presented to Congress, setting forth the large expenditure to which the Institution had been subjected by reason of the accommodation and maintenance of the National Museum, and asking that the usual appropriation of $4,000 which had been made on account of these objects might be increased to $10,000; also that $25,000 might be appropriated towards fitting up the large room in the second story of the main building for the better exhibition of the government collections. In accordance with this resolution the petition was prepared, signed by the Chancellor and Secretary of the Institution, and presented to the House of Representatives by General Garfield, one of the regents. It was referred to the Committee on Appropriations, and although forcibly and eloquently advocated by the members of the Board of Regents belonging to the House, it was not granted, and only the usual appropriation of $4,000 was made. The reasonableness of this petition, which I doubt not under a better condition of the national finances will meet with a more favorable reception, must be manifest when it is considered that $4,000 is the sum which the maintenance of the museum cost the government when it was under the charge of the Patent Office, and that since its removal to the Institution it has been enlarged to threefold its previous size, while the money has been depreciated to one-half its former value; and furthermore, that the amount expended since the fire in 1865, for the reconstruction of the building and supply of furniture, is over $140,000, the greater part of which was for the accommodation of the National Museum. This large sum was rendered necessary by the peculiar character of the architecture, the cost of fire-proof materials, and the high price of labor. Of the above amount, more than $20,000 was defrayed from the annual income of last year, and after this reduction of the resources it was scarcely to be expected that the operations of the Institution could be carried on with as much efficiency as had been the case in years previous to the disaster which entailed on it this heavy incidental expenditure. Yet we venture to hope that the exposition given in the following parts of this report will show the results attained to have been little inferior in value or extent to those of any preceding year.

It will appear from the report of the Executive Committee, that notwithstanding the large draughts which have been made upon the funds on account of the building, they are still in a highly prosperous condition. Thus, while at the beginning of the year 1868 there was a balance in the treasury of about $11,000, with outstanding liabilities contracted principally for repairs and reconstruction to the amount of $22,000; on the other hand, at the beginning of 1869, there is a disposable balance of

$10,352, with bills falling due to the amount of not more than $3,000. The funds are therefore in a better condition at present than they were a year ago by upwards of $18,000. The Institution having paid all indebtedness incurred by repairs on the building, could to-day wind up its affairs not only without debt, but with the capital exhibited in the following statement:

The whole bequest of Smithson, in United States treasury..	$541,379 63
Additions from savings, &c., in United States treasury...	108,620 37
Virginia State stock, $72,760, valued at.....	40,000 00
Cash on hand.....	7,000 00
Total capital.....	697,000 00

While every part of the original programme has been rigidly carried out, the large increase in the capital exhibited in the foregoing statement may justly be claimed as the result of frugal management and a judicious investment of the interest annually accruing.

At the commencement of operations definite lines of policy were adopted, the object of which was to insure the expenditure of the income in such a manner as most effectually to realize the conceptions of the founder in his generous purpose of promoting the "increase and diffusion of knowledge among men." Of the principles judged conducive to this end an important one was embodied in the resolution to co-operate, as far as possible, with individuals and institutions engaged in the same work, especially with those in the city of Washington. An obvious corollary of this was the determination to make no appropriation of the funds to the furtherance or support of any object which could be accomplished as well by other instrumentality. This policy has been frequently referred to in previous reports under the concisely expressed motto, "co-operation not monopoly."

It was in the spirit of this policy that the books of the Institution were last year incorporated with those of Congress and results produced which fully justify the measure as well as illustrate the importance of the principle; for, while by this union under one system and superintendence a library has been formed worthy the National Capital, the capacity of the Smithsonian fund to advance knowledge has been materially increased. In pursuance of the same policy another important arrangement has been made during the past year. I refer to the transfer of the herbarium of the Institution to the care of the Department of Agriculture. This herbarium consists of from 15,000 to 20,000 specimens from all parts of the world, properly classified and labeled. It is the result, in the line of botany, of the various expeditions of the government and of the special explorations of the Institution. The collections have from the first been in the charge of Dr. Gray and Dr. Torrey—the two most eminent botanists in this country—who have scientifically arranged them and formed

the duplicates into sets for distribution. Dr. Gray has, however, left the country for an absence of some years in Europe, and Dr. Torrey, who has devoted at least two entire years of his life to these specimens, is unable longer to continue this gratuitous and disinterested service on account of the more imperious duties of his official position, and consequently intimated to us that the botanical specimens would have to be removed from Columbia College, New York, where they have been deposited under his care. To render such a collection of any practical use, and to preserve the plants from decay, the constant superintendence of a competent botanist is obviously indispensable; but as the appropriation hitherto made by Congress is far too meagre to meet the cost of the present support of the museum it was necessary to seek some other means of providing for these plants. Now, as the Agricultural Department requires for continual reference such a collection of plants, and had begun to gather one; and as, also, in the course of its investigations it has need of the services of a practical botanist, nothing could seem more advisable than to unite the two collections. By this arrangement not only are the series of plants themselves rendered more perfect and more readily accessible, but the Institution is in the same degree relieved of the burden imposed upon it in the support of a multifarious and rapidly increasing museum. The transfer, however, is made with the understanding that the superintending botanist shall be approved by the Institution, that the collection shall be accessible to the public for practical or educational purposes, and to the Institution for scientific investigation or for supplying any information that may be asked for by its correspondents in regard to the names and character of plants. It is further stipulated that due credit shall be given to the Institution in the publications of the department for the deposit of the original specimens as well as for the additions which from time to time may be made to them by the Institution.

Agreeably to the policy above mentioned, the Institution has also entered into an arrangement with the medical department of the United States army by which it was thought mutual convenience and harmonious co-operation would be promoted. By this arrangement the Institution transfers to the museum in charge of the Surgeon General its large collection of human crania, and also all its specimens pertaining to anatomy, physiology, medicine, and surgery, while it takes, in return, from the medical museum all the collections which more properly relate to ethnology. It will be seen that the object kept constantly in view in these transactions is to render the various collections in Washington, which have been made under the direction of the government and the Institution, definite parts of one harmonious system, and at the same time to avoid the loss of labor and of means, in duplicating and preserving articles of a similar character in separate establishments.

The disposition, which up to this time, has been made of the plants illustrates the plan which was adopted, from the first, in order to pro-

duce the most important results with a given expenditure of means. The funds of the Institution, it was seen, were not sufficient to carry out all the objects contemplated in the original law of organization. To sustain properly a national museum and render it an efficient means of popular instruction would require a number of professors of the different branches into which natural history has been divided. But, as the income was manifestly insufficient for this purpose, the plan was adopted of calling in, as far as possible, the aid of individual collaborators and of other institutions. Agreeably to this principle of action the plants were given in charge, as has been stated, to Doctors Gray and Torrey for naming and arrangement into sets, and to the latter gentleman for safe keeping until such time as means could be provided for their maintenance in Washington.

For the same reason as that just given, all the type specimens of insects which have been collected by the Institution have been divided among collaborators for study and arrangement, to be reclaimed at any time when required by the Institution. Nor is this system of co-operation confined to this country, for while through its exchanges the Institution holds friendly correspondence with all the principal scientific and literary establishments of the Old World, with a number of them it maintains relations of mutual co-operation in the way of affording assistance by sending rare specimens and furnishing required data in cases of special investigations.

While the result of the policy which has been adopted is the immediate advancement of knowledge, it tends incidentally to render the seat of government a center of scientific activity, which enlarges its reputation and extends its influence. Indeed, though Washington has generally been regarded as almost exclusively a focus of political agitation, it in reality contains a greater number of persons connected with scientific operations, and interested in intellectual pursuits, than any other city of equal population in this country. In illustration of this remark I need only mention the officers of the Engineer Department, of the Coast Survey, of the Light-house Board, of the Ordnance Bureau, of the army and the navy, of the Patent Office, and of the Agricultural Department; also the computors of the Nautical Almanac, the professors of the National Observatory, and those of three colleges, three medical schools, a law school, and of an institution for the deaf and dumb; besides the the directors and assistants of the asylum for the insane, two hospitals, and of the various bureaus of the government, the greater part of whom are men of more than ordinary culture, on many of whom the Institution can call for assistance and co-operation.

Publications.—The Smithsonian publications, as has been frequently stated before, are of three classes: the Contributions to Knowledge, the

Miscellaneous Collections, and the Annual Reports. The first consists of memoirs containing positive additions to science resting on original research, and which are principally the result of investigations to which the Institution has in some way rendered assistance. In all cases the memoirs are submitted to a commission for critical examination, and only accepted for publication on a favorable report. The Miscellaneous Collections are chiefly composed of works intended to facilitate the study of certain branches of natural history or of meteorology, and are designed especially to induce individuals to engage in studies as specialties, to which in leisure moments their thoughts may recur, and by observations and collections in relation to which they may not only contribute to their own pleasure but also advance the cause of science. The Annual Reports are published at the expense of the government, with the exception of the illustrations, which are furnished by the Institution. Up to the year 1854 these reports were published in a pamphlet form, and contained merely an account of the operations of the Institution for the year; but since that date an appendix has been added, principally consisting of translations, from foreign journals, of articles not accessible to the English reader, but of interest to our meteorological observers, and to persons generally who are interested in the progress of knowledge. With the addition of this appendix each report forms a volume of between 400 and 500 pages, bound in boards, with a cloth cover. The first volume of this series contains a reprint of all the previous reports of the Secretary, the will of Smithson, and the enactments of Congress in regard to the bequest, and hence in the full set of these reports a continuous history of the Institution is given from its organization to the present time. The whole number of volumes, including the present, is fifteen; of these it is to be regretted that the greater part of the extra numbers were destroyed in the fire of 1865. All the reports since 1862 have been stereotyped, and the plates of these have been preserved.

During the past year the 15th volume of the Smithsonian Contributions to Knowledge has been published, and, in conformity with the rules adopted, has been distributed to institutions in this country and abroad. The volume contains 604 pages, and is illustrated with 43 woodcuts and 17 plates. The several articles contained in this volume which were published separately, and an account of which was given in previous reports, are as follows:

1. An investigation of the Orbit of Neptune, with general tables of its motion, by Professor Simon Newcomb.

2. On the fresh-water glacial drift of the northwestern States, by Charles Whittlesey.

3. Geological researches in China, Mongolia, and Japan, during the years 1862 to 1865, by Raphael Pumpelly.

4. Physical observations in the Arctic seas, by Isaac I. Hayes, M. D.

Another publication during the year, which is intended to form a part

of the 16th volume of the Contributions, is entitled "Results of meteorological observations at Marietta, Ohio, between 1826 and 1859," by Dr. S. P. Hildreth. An account of this was given in the last report under the head of meteorology, and copies of it have been distributed to the meteorological observers. It contains 46 quarto pages, and is illustrated with 14 woodcuts.

Several parts of the miscellaneous collections have also been published. The first is a catalogue of the Orthoptera or upright winged insects of North America, described previous to 1867, prepared for the Smithsonian Institution by Samuel H. Scudder, of the Boston Society of Natural History. This work is intended as an index in which the student can find a reference to every published account of any species of Orthoptera found on the continent of North America or in the West Indies, together with the exact names given to the insects in the original descriptions. The publication and distribution of this list will assist the author himself in obtaining materials for a contemplated elaborate monograph on the same subject, while it will tend to advance science by calling attention to this interesting but heretofore little studied order of insects; an order which includes, however, among others, the cockroach and the grasshopper—the one so prejudicial to domestic comfort, and the other so often subversive of the hopes of the farmer. The preparation of this work is a gratuitous contribution by Mr. Scudder to the branch of natural history in which he is specially interested. It consists of 89 octavo pages, and will form a part of the eighth volume of miscellaneous collections.

The next publication of the year 1868 is a volume forming part four of a series of monographs of the Diptera, or two-winged insects of North America, by Baron R. Osten Sacken. Parts one and two of the same series previously published by the Institution were prepared by Dr. H. Loew, of Prussia, and the third part is in an advanced state of preparation by the same author. This volume contains the first part of a monograph of the North American *Tipulidæ*, the representative of which is known as the crane-fly, an insect whose larvæ are extremely destructive to crops of various kinds, devouring the roots of cereals and pasture grasses, and almost all the plants ordinarily cultivated in fields or gardens. The ground covered by the author in this monograph embraces all the known North American species, exclusive of those of the West Indies and Mexico. The principal areas from which the specimens described have been obtained are the environs of the cities of Washington and of New York, but the author also made collections during occasional excursions to different parts of New York, Pennsylvania, and New England, besides receiving contributions from other parts of this continent. Thus, as far as the more common species are concerned, the middle and northern States may be said to be tolerably well represented in this volume, the regions west of the Allegha-

nies and the British Provinces not so fully, while the country south of Washington is, in this respect, almost entirely unexplored. The author as well as the Institution is indebted to Mr. Samuel Powel, of Newport, Rhode Island, an amateur and patron of science, for the devotion of much time and practical skill to the preparation of magnified photographs of the wings, from which the illustrations presented on the steel plates were reduced. This volume contains 345 pages, illustrated with four plates and seven woodcuts.

Among the memoirs accepted for publication, and formerly described, is one by Dr. John Dean, giving the results of a series of microscopical investigations of the *medulla oblongata*. This paper was stereotyped and about to be published as a part of the 13th volume of the Contributions, when the expensive steel plates for its illustration were destroyed by the fire of 1865. Owing to the absence of Dr. Dean in Europe, a considerable delay has occurred in procuring a new set of these illustrations. The stereotype plates of the letter-press were, fortunately, preserved, and we are now ready to publish an edition of the memoir for distribution as a part of the 16th volume of the Contributions.

Since the last report an elaborate work founded principally on original research has been presented to the Institution, by Lewis H. Morgan, esq., of Rochester, New York. It is on the systems of relationship adopted by different races and tribes of men. About 20 years ago the author found in use among the Iroquois Indians, of the State of New York, a system for the designation and classification of family relationship of a singular character and wholly unlike any with which he was previously familiar. Under this system, for example, all the children of the several brothers and sisters of an individual are considered as his own children; all the brothers of his father are habitually regarded and addressed as his own father; all the sisters of his mother as his mother, &c. Mr. Morgan afterwards found the same system in use among other Indian nations, in which, while every term of relationship was radically different from the corresponding terms in the Iroquois, the classification was the same. Extending the research to other fields of inquiry, he found before the close of 1859 that the same system prevailed among the principal Indian nations east of the Rocky mountains, and that traces of it existed both in the Sandwich Islands and in south India. He therefore resolved to prosecute the investigation upon a still more comprehensive scale, and to attempt, if possible, to investigate the systems adopted by the different families of mankind. This, however, required a more extensive foreign correspondence than a private individual could hope successfully to maintain. He therefore made application to the different boards of foreign missions, and also to the Smithsonian Institution, for such co-operation in the furtherance of his object as it might be in their power to afford. The Institution accordingly issued circulars and schedules, which were distributed to its correspondents in all parts of the world. Through his own immediate labors and the assistance just mentioned,

the author has been able to construct tables of relationship of as many as 70 Indian nations, speaking as many independent dialects, and also tables of the systems of the principal nations of Europe and Asia, a portion of those of Africa, of Central and South America, and of the islands of the Pacific. The tabulated schedules will represent the systems of relationship of upwards of four-fifths of the entire human family.

The memoir presents in a brief form the following systems or methods of indicating the relations of consanguinity: 1st. That of the Aryan family, as typified by the Roman form. 2d. That of the Malayan family, as indicated by the Hawaiian mode. 3d. That of the American Indian family, as represented by the Seneca-Iroquois. According to the author's generalizations all these systems of consanguinity resolve themselves into two radically distinct forms, one of which he calls the descriptive and the other the classificatory form. The first assumes as its fundamental basis the antecedent existence of marriage between single pairs. Before it could have come into existence mankind must have made some advances in civilization; it follows the regular course of descent, describing each individual with reference to his parental derivation. In the second form the relation of consanguinity is only given in classes, the same term of consanguinity being applied to a number of persons not standing in precisely the same proximity of actual relationship. This system, according to the author, seems to indicate that it was adopted in a state of society in which marriage between single pairs was unknown or exceptional. This memoir was first referred to a commission, consisting of Professor J. H. McIlvaine and Professor William Henry Green, of Princeton, New Jersey, who recommended its publication, but advised certain changes in the method of presenting the subject. After these modifications had been made it was submitted to the American Oriental Society and was by it referred to a special committee, consisting of Messrs. Hadley, Trumbull, and Whitney, who, having critically examined the memoir, reported that it contained a series of highly interesting facts which they believed the students of philology and ethnology, though they might not accept all the conclusions of the author, would welcome as valuable contributions to science.

Besides the foregoing the following papers have been accepted for publication and are now in the hands of the printer:

The Indians of Cape Flattery: by J. G. Swan; Investigation of the Path of a Meteoric Fire-ball: by Professor J. H. Coffin, of Lafayette College; Description of a part of a Mummy Case: by Dr. Charles Pickering; Land and Fresh-water Shells of North America: by W. G. Binney and Thos. Bland.

In addition to the foregoing the discussion and reduction of all the observations relative to the rainfall of the north American continent have been completed and will be published during 1869. The whole amount expended during the past year for publications was about $6,800.

A larger sum, however, will be required for this purpose during the present year.

The Smithsonian Institution is now in possession of a large amount of manuscript material relative to the natural history, geology, and ethnology of the whole of the northern part of the American continent, extending from Labrador to Behring's straits, and northward to the Arctic sea, including Greenland and the vicinity of Von Wrangell's land. These materials have been derived principally from special explorations, directed by the Smithsonian Institution, and with the co-operation to a greater or less extent of the Chicago Academy of Sciences. They have been gathered by the officers of the Hudson's Bay Company, at their stations in various parts of the northern portion of the continent, by the scientific corps of the Russian telegraph expedition, and by special explorers acting under the immediate auspices of the Institution. That part which relates to natural history is now nearly ready for the press, and will probably be published during the coming year, while that relative to physical geography is in an advanced stage of preparation. This includes all the scientific reports made to the Russian telegraph company by its employés, and liberally furnished, by the company or its officers, to the Institution. The material also contains a large number of vocabularies as well as other information relative to the languages of the country, which we hope soon to have in a proper state for publication. All these contributions, together with the observations of Kane, McClintock, and Hayes, which have been discussed and published by the Institution, form no small addition to the knowledge of the North American continent, and will forever remain a monument of the munificence and a memorial of the name of Smithson.

The annual report for the year 1867 was printed as usual by order of Congress, and the extra number of 10,000 copies ordered as heretofore. In addition to the report of the secretary, giving an account of the operations, expenditures, and condition of the Institution for the year, and the proceedings of the Board of Regents to May 2, 1868, it contains the following articles: biographical notices of Professor C. C. Jewett, formerly librarian of the Institution; of William Henry Harvey, of Dublin, author of an extensive work on Algæ, published by the Institution; memoirs of Legendre, Peltier, and Faraday; a sketch of the history of the Royal Institution of Great Britain; a memoir on the family Jussieu, and the natural method of classification in botany; the natural history of organized bodies; the electrical currents of the earth; considerations and facts relative to electricity; queries about expression for anthropological inquiry; the various modes of flight in relation to æronautics; man as the cotemporary of the mammoth and reindeer in middle Europe; photo-chemistry; an account of the astronomical observations at Dorpat and Poulkova; traces of the early mental condition of man, account of Indian remains, ancient mounds, &c.; explorations in Central America and Lake Winnepeg; sketch of the flora of

Alaska; various letters on meteorology; prize questions of societies in Europe; and a list of abbreviations used in England at the present time. This publication is constantly growing in popularity, and, next to the report of the Agricultural Department, no document is in greater demand. We may mention, as a proof of this, that a considerable portion of the copies allowed the Institution for distribution among its own correspondents has been absorbed, during the last year, in meeting the applications of members of Congress for the supply of their constituents. In complying with these applications we have never failed to represent that a larger edition of the report is highly desirable for distribution, both by the Institution and Congress, and that an addition of 5,000 copies to the number which has been printed would cost comparatively but a trifle after the stereotype plates have been placed upon the cylinder of the printing press.

Explorations and collections in natural history.—From the first establishment of the Smithsonian Institution until the present time a considerable portion of its annual resources has been devoted to explorations for the development of the natural productions of North and Central America, particularly in relation to zoology, botany, and mineralogy. Of late years a number of other institutions have entered the same field, either independently or in co-operation with this Institution. Foremost among those which have made separate explorations is the great museum of comparative zoology at Cambridge, under the direction of Professor Agassiz. The late expedition of this renowned naturalist to South America has been crowned with a larger collection of specimens in zoology than has ever been obtained through the exertions of private enterprise. Among societies which have co-operated during the past year with the Smithsonian, and scarcely in a rank below any other in regard to zeal and efficiency, are the Chicago Academy of Science, the Boston Society of Natural History, and the Peabody Museum of American Archæology and Ethnology of Cambridge, Mass., as also the Kentucky University of Lexington. In giving an account of what has been done during the year under review in the line of natural history we shall adopt, as in previous reports, the geographical order.

In reference to *Arctic* America the contributions from Mr. Macfarlane and Mr. McDougal of the Mackenzie river district have added largely to the materials previously received from that region, and are of special interest in regard to Oölogy. The last invoice from Mr. Macfarlane is fully equal to those with which he has favored the Institution in previous years, and entitles him to the credit of being the largest contributor to the Smithsonian collections, and of having done more than any other person in making known the productions and character of the regions he has explored. The record of specimens bearing his name already amounts to over ten thousand entries, including some of the choicest contributions to natural history and ethnology. A collection of birds

and eggs, including some new species of the latter from west of Lake Winnipeg, has been received from Mr. Donald Gunn, and of insects and birds from the vicinity of Hudson's bay from Mr. James Lockhart and Mr. B. R. Ross, to both of whom acknowledgments for valuable services have been frequently rendered in previous reports.

Mr. W. H. Dall, who was mentioned in the last report as having succeeded Mr. Kennicott as chief of the natural history corps of the Russian telegraph expedition, remained after the abandonment of that enterprise to continue his explorations among the Indians and Esquimaux along the Yukon, and within the Arctic Circle, including the most northern part of our new possessions. He has just returned and brought with him a valuable collection of the natural productions, as well as illustrations of the ethnology of the regions he has visited. Mr. Dall visited Sitka with the telegraph expedition, in 1865, then went to the Aleutian islands, and afterwards to Plover bay, in Eastern Siberia. He spent the winter of 1866 in the vicinity of St. Michael's, Norton's sound; went the next spring, with a single companion, to Fort Yukon, near the headwaters of the river of the same name, and continued his explorations on either side of the Arctic Circle until September, when he returned to Norton's sound to report the result of his labors to the engineer-in-chief of the telegraphic expedition. But learning that the enterprise had been abandoned, he concluded to remain in the country and continue the exploration on his own account. In the prosecution of this purpose he left St. Michael's in October, and spent the following winter among the Indians and Esquimaux, in the region between the Yukon and Norton's sound. In the spring he descended the Yukon, and in July commenced his homeward journey. His collections are rich in birds, eggs, plants, smaller animals, fish, fossils, and especially in ethnological illustrations. He also made copious notes on the physical geography, geology, and meteorology of the country. The first winter—1866–'67—was very cold, the thermometer descending, near Nulato, as low as 68° below zero. The second was much warmer; rain fell almost every day, and, with the exception of one occasion, the thermometer ranged from 10° below to 8° or 10° above the freezing point. As if, however, to compensate for this, the spring was longer and colder than had been known for 16 previous years. The short summers are quite warm, no snow remaining on the ground. Rapidly growing vegetables are cultivated by the Russian traders, such as turnips, radishes, and lettuce. An attempt to grow potatoes failed at St. Michael's, although a similar experiment is said to have been successful at Fort Yukon. This part of the country is of no value in an agricultural point of view, but affords an abundance of rich furs. It is thickly wooded in the interior, principally with spruce, poplar, and willow. Mr. Dall was kindly entertained by the inhabitants, who, on all the coasts north of the Aleutian islands and on that of the Arctic sea, consist of Esquimaux, while the inhabitants of the interior are Indians.

The expenses of original outfit for making collections in natural history during the telegraphic expedition were defrayed by the joint contributions of this Institution and the Chicago Academy of Science. Subsequently the telegraphic company itself made liberal provisions for facilitating the same object, and for furthering, as far as compatible with the primary intention of the enterprise, the advance of science. The costs of the expedition of Mr. Dall, after he left the service of the telegraph company, were borne by himself, and the results generously presented as a contribution to the cause to which he has shown himself so ardently attached. The transportation of all the collections from the western coast devolved upon the Institution, and but for the generous assistance of the Pacific Mail Steamship Company, it would have called for a larger outlay than we could well have afforded. Since Mr. Dall's return he has occupied a room in the Smithsonian building, and has been engaged in arranging and labeling his specimens preparatory to the formation of a descriptive catalogue. While he has been occupied in this work the Boston Society of Natural History, as well as the Institution, has contributed to his support, with the understanding that the former is to have a portion of the duplicates set apart for distribution.

Other collections of interest have also been received from Alaska, viz: those made by Mr. Bischoff, at Kodiak; and by Dr. Minor, in various localities visited during the cruise of the Wayanda; others still, from Captain White, of the same steamer; also from Captain Howard and Mr. George Davidson, of the United States Coast Survey.

Western United States.—The Institution still continues to receive specimens from the Pacific coast, and frequent communications relative to the physical geography, meteorology, and ethnology of the country. During the past year among the more important collections from California was a series of nests and eggs from Dr. Canfield, of Monterey, and of birds and shells from Mr. R. E. C. Stearns. But the most important exploration undertaken since the date of the last report has been that under the direction of Mr. Clarence King, authorized by Congress for a geological survey of the 40th parallel of latitude, principally in Nevada and the western portion of Utah. The results of this exploration are especially important from the facts obtained relative to the physical geography and meteorology of the country. A base line in a north and south direction was measured by astronomical observations at the two extremities, and from this a net-work of triangles was extended over the region surveyed, by which the topography was determined and the materials furnished of an accurate map of a part of the country previously imperfectly known. The party consisted of four geologists, including Mr. King, four topographers, two botanists, one zoologist, and one meteorologist. All the specimens collected, filling 60 boxes, with the exception of those of botany, have been received at the Institution, and are now in process of being arranged for study and subsequent distribution. The botanical collections have been given in charge to Professor

Eaton, of Yale College, for the determination of the species and their relations to the flora of other portions of the United States, but will finally be sent to the Institution, to the care of which all specimens collected by government expeditions are assigned. In the same connection it may be mentioned that Dr. Hitz has continued his explorations on the upper Missouri, and contributed specimens of fossils, skins of birds, eggs, &c.

At the last session of Congress an appropriation was made for explorations under the direction of the Land Office. This survey, the conduct of which was consigned to Dr. F. V. Hayden, extended over the Black hills, Laramie plains, the headwaters of the Little and Big Laramie rivers to Bridger's pass. It also included a survey along the Pacific railroad from Fort Saunders to Green river. The report of this survey has been made to Joseph S. Wilson, esq., the Commissioner of the Land Office, with whom all the specimens collected have been deposited. Dr. Hayden, however, made an independent survey under the auspices of the Institution, along the eastern base of the Rocky mountains to Denver city, and southward to the Sangre de Christo pass, across the San Luis Potosi park and the valley of the Rio Grande, and thence into New Mexico, returning northward through the Poncho pass, across the Arkansas into the South park, and through this into the mining regions of Colorado. Besides the geological notes which were made during this expedition, a large number of specimens was collected; and as no appropriation of Congress was made for the transportation of the latter, the cost has been defrayed by the Institution. The specimens have been received and are now awaiting their examination and final disposition. Another exploration which will be mentioned under the head of ethnology, was conducted by Dr. E. Palmer, in the Indian territory, the collections from which were but little less important as illustrative of natural history than of Indian life and ethnology. Dr. Palmer is now in the Institution assorting the specimens and preparing his notes for publication.

Middle and South America.—Colonel Grayson has been engaged in prosecuting his exploration in northwestern Mexico, and has furnished large collections of its ornithology. To him more than to any other may justly be ascribed, says Professor Baird, a knowledge of the species of birds of that region. Under the joint auspices of the Smithsonian Institution and the Kentucky University, at Lexington, Professor Sumichrast, a well-known naturalist long resident in Mexico, has gone to the Isthmus of Tehuantepec to make observations and collections in natural history, which will doubtless throw light upon the geographical distribution of species. Two boxes of specimens have just been received as the first fruits of this expedition. Dr. Sartorius has also continued his important contributions from Mirador. Explorations have been further prosecuted in Costa Rica, a region which has been the subject of much attention on the part of the Institution, and a valuable collection of specimens has been received from Mr. M. Calleja, made by himself and Mr. J. Zeledon, as

well as contributions from Dr. Von Frantzius, from Captain J. M. Dow, Mr. Henry Hague, Mr. George Latimer, Dr. Destruges, and other correspondents mentioned in the list of donors. A series of birds of the Galapagos islands has been presented by the Swedish Academy of Sciences through Professor Sundevall, furnishing us with the first illustrations of the fauna of that group, so remarkable for its land and marine animals. Mr. W. H. Hudson has continued to make collections of birds in the Argentine provinces, and Mr. Albuquerque and Dr. Smith have rendered the same service in regard to those of Brazil. Specimens from Peru have been received from Dr. Sclater, while Mr. Salvin has sent types of several new species from Veragua, on the isthmus of Panama.

Explorations and collections in ethnology.—During the past year greater effort has been made than ever before to collect specimens to illustrate the ethnology and archæology of the North American continent. This subject, it is true, has from the first been an object of interest to the Institution, as being a common ground on which the cultivators of science and of literature might harmoniously co-operate. It embraces not only the natural history and peculiarities of the different races of men as they now exist upon the globe, but also their affiliations, their changes in mental and moral development, and also the question of the geological epoch of the appearance of man upon the earth. So much interest has been awakened in the general subject, that Mr. George Peabody, with an enlightened liberality, has presented $150,000 to Harvard University, at Cambridge, for the foundation and maintenance of a museum and professorship of American ethnology and archæology, Although the funds of that establishment are not yet fully available. measures have been taken, under the direction of Professor Jeffries Wyman, to secure European specimens for comparison, and also to commence the collection of original records of the races of our continent. The Smithsonian Institution having inaugurated a number of special explorations, embracing ethnology as well as natural history, has invited the Peabody museum to co-operate in the enterprises, by contributing funds, with a view to sharing the results of the expeditions. This proposition has been favorably entertained, and an appropriation been made to assist an important exploration of ancient mounds in Kentucky, under the direction of Mr. Sidney S. Lyon. We cherish the hope that, as the funds of the Peabody museum become more and more available, our union of effort to extensively examine the monuments and collect all the relics, to illustrate as fully as possible the archæology and ethnology of the American continent, will be crowned with success.

The interest in the archæological remains of America is by no means confined to this country. They are considered of much importance in Europe in the way of comparison with those of the old world, and specimens have been diligently sought for by collectors from abroad. Mr. William Blackmore, of Liverpool, in particular, a gentleman of wealth

and intelligence who has founded an ethnological museum at Salisbury, has made several visits to this country for the purpose of obtaining additions to his collections. He has purchased of Dr. E. H. Davis, for a large sum of money, the archæological specimens described and figured in volume I of the Smithsonian Contributions to Knowledge. Though it may, perhaps, be a matter of regret that Congress did not make an appropriation for the purchase of these interesting specimens, it is still gratifying to the lovers of science, irrespective of nationality, that they will be perpetually preserved and rendered available for the advancement of ethnology. While we ourselves were not able to retain in this country the originals, we have procured a complete set of facsimiles in plaster, which, for general investigation, are nearly as valuable as those from which they were taken.

The Institution is indebted to Mr. Blackmore for a series of photographs of American Indians; a model of Stonehenge; a number of electrotype copies of ancient medals; and a copy of a work written by Thomas Inman, M. D., for private distribution, on "Ancient Faith embodied in Ancient Names." Mr. Blackmore is enthusiastically interested in ethnology, and devotes his spare time, as well as a large portion of his ample means, to the prosecution of the subject. The museum which he has founded and munificently endowed consists of specimens intended to illustrate the anthropology of every part of the world, and is freely opened to the public, either for casual visits or for critical study. An account of it will be given in the appendix of this report, under the head of ethnology. We have found in Mr. Blackmore an efficient and liberal collaborator, who evinces a disposition amply to repay, in returns of specimens and information, the contributions we may be able to make to the stores he has already accumulated. In his late visit to this country he thinks he has found specimens of the early drift period, or of the first indications of the works of man on the earth, not previously known to exist on this continent. The locality of these remains is about 50 miles from Fort Bridger, in Utah Territory, and will not be forgotten as a point of special interest in our explorations.

It is now generally known that, in times long anterior to the dawn of authentic history, the practice extensively prevailed of constructing human habitations upon wooden piles driven into the shallow water of lakes, remains of which have been found especially in Switzerland, but also in other countries. Upon these piles platforms were placed and habitations erected, not for temporary occupation, merely, but for prolonged residence. Of these archæological remains accounts have been given in previous reports, and during the past year arrangements have been made, through the exchanges of the Institution, to obtain specimens from the more important localities in which they are found.

The following is an account of the more important explorations and additions to the collections of the Institution which have been made

during the past year in the line of ethnology. The first in value is that already referred to as having been undertaken under the joint auspices of the Institution and the Peabody Museum, by Mr. S. S. Lyon, of Indiana. In this exploration a number of mounds in Kentucky were opened, and more than fifty perfect crania, with many imperfect ones, and a considerable number of skeletons, were procured. There were disinterred also about thirty vases more or less perfect, a large number of stone axes, hammers, ornaments, beads, bone awls, &c., the whole filling seven barrels and four boxes with extremely valuable material. The crania and bones were referred to Dr. Wyman for special investigation, who reports that they had been received, that he had nearly finished cleaning the skulls, which would require many repairs, but that he hoped to do justice to a collection which affords an opportunity never before equaled of examining the skulls of American aborigines. Mr. Lyon's exploration has also furnished a series of ancient implements as well as casts of footprints sculptured in the rocks. Imitations of this kind, which have been frequently found, were for a long time supposed to have been formed by the actual impressions of human feet when the rock was in a soft condition, but subsequent investigations have shown them to be undoubtedly sculptured imitations of footprints. They have occasionally been found in rocks containing pebbles, but in these cases the pebbles, instead of bearing evidence of having been pressed down into a plastic material by a human foot, show clearly that they have been cut by the tool of a workman.

Professor J. W. P. Jenks, of Middleboro', Massachusetts, who has for many years been collecting objects of ethnology, has, in a spirit of praiseworthy liberality, allowed the Institution to select any specimens it might desire from his extensive cabinet. From the same place, some choice objects have also been received from Mr. Sylvester, as well as an interesting stone mortar and a stone axe, respectively the gift of Mr. E. Shaw and Mr. U. Sampson. Mr. Gregory, of Marblehead, has furnished some desirable specimens from eastern Massachusetts, as have also Mr. Levi Cole, of Beverly, Dr. Palmer, of Ipswich, Mr. Blake, of Boston, Mr. Burr, Mrs. Bryant, Mr. Jas. T. Ames, &c. To Amherst College, through Professor Hitchcock, the Institution is indebted for a large number of stone implements from western Massachusetts and Connecticut. Explorations of ancient Indian graves were also made, with satisfactory results, near Hingham, Massachusetts, by Professor Baird, in conjunction with Dr. Brewer, Messrs. John Brewer, T. J. Bouve, F. Burr, Gerrish, and Wells.

To Dr. W. Wood, of East Windsor Hill, Connecticut, the Institution is under obligations for his diligent efforts to increase its archæological collections; a number of boxes have been received from him filled with articles illustrative of the primitive stone implements of Connecticut. Valued contributions from an adjacent locality have also been received from Mr. Andrus. Special contributions of implements previously col-

lected in Maine, New Brunswick, and Pennsylvania, were likewise made by Mr. Boardman, Dr. Todd, Mr. Blake, Mr. Haley, Mr. Leonard Peabody, Mr. Hollis, and Mr. J. Hamilton. From Colonel E. Jewett, of Utica, the Institution has received an extensive and choice collection of relics especially rich in pipes and ornaments, beads, amulets. &c., gathered principally in New York and adjacent States. Mr. Robert Howell, of Tioga county, New York, has made several interesting contributions in the same line, and others have been received from the same region at the hands of Mr. Stephen Forman and Mr. Jacob Stratton. Scarcely inferior in extent and variety to the collection of Mr. Jenks is one made by the late Hon. George M. Keim, of Reading, principally in central Pennsylvania, but also in Texas and Ohio. In this is found the first specimen of a choice flint hoe, similar to that described by Professor Rau, in the Smithsonian Report for 1863, a second specimen of which has just been received from Mr. Granville Turner, of Illinois. The collection of General Keim was presented to the Institution by his children as a memorial of their father, and a very large and choice cabinet of minerals has, we learn, been given by them to Lehigh University with a similar object. Specimens from western Pennsylvania have been received from Dr. Walker.

The principal donations from the vicinity of Washington have been made by Mr. O. N. Bryan, some of which are very choice; by Mr. J. W. Slagle, and Mr. Tyler. Specimens from the eastern shore of Virginia have been presented by Mr. C. R. Moore. Mr. W. H. Edwards, of West Virginia, has contributed a number of choice articles from the Kanawha river and elsewhere, some of them unique. Mr. E. A. Dayton, an esteemed correspondent of the Institution, in the course of an extended tour through Tennessee and Kentucky last year, took advantage of the occasion to gather collections, and awaken an interest in the subject which has resulted in large additions to our cabinet. Our attention having been called by Mr. Dayton to a remarkable stone idol found near the mouth of a cave at Strawberry Plains, Tennessee, a correspondence was entered into with its owner, Captain E. M. Grant, which resulted in its being sent to the Institution. The most important collection of ethnological material yet received, however, is that presented by Captain J. H. Devereux, of Cleveland, Ohio, embracing a large number of nearly every variety of ancient stone implements, principally of Tennessee and Ohio, among them specimens of pottery of very different patterns from those usually met with. Some of them are remarkable for smoothness of surface and symmetry of outline, as well as for the style of ornamentation. We have stated before that a series of casts of the principal objects described in the first volume of the Smithsonian Contributions to Knowledge had been purchased, and it may be mentioned in this connection that other articles described in the same volume are in possession of Mr. W. S. Vaux, of Philadelphia, who obtained them through the purchase of the valuable collection of Mr. James McBride, of Ohio, whose

cabinet was freely open for study to Squier and Davis. From Lieutenant Belden and Captain Mills, of the United States army, Drs. C. C. Gray and Matthews, fine collections of dresses and implements of existing tribes of Indians have been received. The most extensive series, however, of modern objects of this kind pertaining to the United States, and obtained during the year under review, is that gathered by Dr. Edward Palmer, in the Indian territory, including specimens relating to the Comanches, Kioways, and other neighboring tribes. The collection consists of war implements, such as bows, arrows, shields, battle-axes; hunting and fishing implements, such as hooks, spears, nets, &c.; a large variety of dresses, ornaments, including ear and finger rings, breast-plates, &c.; tobacco-pouches, pipes of various materials, bowls, spoons made of wood and horn, a variety of whips, articles used for gambling, including packs of cards made of skins, and bundles of sticks with which bets are decided, from the manner in which they fall when thrown upwards; also floor coverings made of parallel sticks attached by sinews; the whole forming very complete illustrations of the manners and customs of the tribes before mentioned.

Some of the most important additions of the year to the stone series were included in a collection presented by Dr. Yates, of California. This collection embraced, in addition to a number of characteristic implements of the natives of California, moulds of those found under the lava of Table mountain, and which formed the subject of an animated discussion at the meeting of the American Association in Chicago last summer. It is proposed to make casts from these moulds for distribution to the principal museums in this country and abroad. Extensive collections were made in Alaska, during the year, by Dr. T. T. Minor, surgeon of the United States steamer Wayanda, embracing stone articles of superior finish. Other objects, to which much value is attached, from the same region, have been received from Captain Howard and Captain J. W. White; and very extensive collections made by Mr. Dall are on their way. Mr. R. Macfarlane and Mr. Strachan Jones have furnished continuations of collections previously contributed, in articles relative to the Esquimaux of the northern coast of America. Thanks to the co-operation of the officers of the Hudson's Bay Company, among whom may be mentioned Messrs. Ross, Gaudet, Hardisty, and Kirkby, but especially Macfarlane, the Institution is in possession of what would appear to be a full representation of the life of the Esquimaux of that region, as illustrated by their dresses, weapons of war, their implements for fishing and the chase, household articles, ornaments, &c.

In this connection mention should not be omitted of a number of interesting stone implements contributed by Mrs. H. R. Schoolcraft, of Washington, the widow of the celebrated ethnologist, some of which are described in his elaborate work on the Indian tribes of North America. Among other articles for which the Institution is indebted to the liberality of Mrs. Schoolcraft is a cast of the inscription on Dighton Rock,

Massachusetts, sometimes supposed to be of Runic origin, but which, like the drawings on the same rock, are generally considered as having been made by the primitive Indian occupants of that region.

It will have been observed that nearly all the additions to the ethnological collections referred to, have been from the United States and British possessions. Very important donations have, however, been received from other parts of America. Captain J. M. Dow, of New York, has presented the Institution with a collection of ancient pottery, of stone images and implements from Nicaragua, Costa Rica, and Chiriqui, some of them of remarkable character. Other specimens of Chiriqui pottery were included in the collection of Colonel Jewett, already referred to. Mr. George A. Latimer, of Porto Rico, has presented remarkable stone implements of the ancient inhabitants of the West Indies, among which is a specimen in the shape of an ellipsoidal stone ring, not unlike a horse collar in form, though rather less in size, being about 15 inches in its largest diameter. It was possibly worn about the neck as a badge of office in public processions. From Captain Dow we have received another wrought stone in the form of a large inverted U. It is conjectured that it might have been placed across the neck of the victim when stretched on the altar of sacrifice.

The occasion here presents itself of stating that in a communication, through the Department of State, from Mr. de Cesnola, United States consul at Cyprus, we were informed that a remarkable discovery of Phœnician and Greek antiquities had lately been made in that island, and that two boxes of the specimens were in readiness to be transmitted to Washington as presents for the National Museum. On the receipt of this information a letter was addressed to the Secretary of the Navy, asking that, if not incompatible with the rules of the service, some United States vessel, being in the vicinity, might be authorized to stop at the island and procure the articles above designated. To this letter a prompt answer was received from the Navy Department, containing the information that orders in accordance with the request had been issued to the commander of the Mediterranean squadron. The following are some of the facts in regard to the discovery in question. In the month of December, 1867, a Greek laborer, digging for building-stone within the precincts of a little village called Galli, found a very old oven-shaped tomb, containing pieces of skulls and other bones, and also some curious colored vases. On examining the ground a few yards in circuit other tombs were found, indicating the existence of an ancient burial-site. The discovery was kept secret from the authorities of the place, but was disclosed to the foreign consuls on the island, by whom the search was prosecuted. The American consul, Mr. Cesnola, obtained from the Turkish government at Constantinople a firman allowing him to search for antiquities wherever he might desire. With this he succeeded in discovering the existence of a series of Phœnician tombs beneath the ancient Greek burial ground. These tombs, which were

oven-shaped, with the mouth closed by large stones, were six and a half feet below the level of the Greek interments, and from nine to eleven feet below the surface of the earth. The articles found in the graves and tombs were of gold, silver, precious stones, bronze, copper, glass, marble, and terra cotta. The whole collection numbered 2,310 pieces; the expense of the digging, $7,300 in gold, was defrayed by an association composed of the English, French, and American consuls, and an English banker. We need not say that the safe arrival of the portion of these relics intended by Mr. Cesnola for the Smithsonian Institution will be looked forward to with much interest.

But the explorations of the Institution in regard to ethnology have not been confined to the contents of mounds or to implements gathered from the surface of the ground, or brought to light by casual excavation. It is well known that in almost every part of the world contiguous to the sea there exist accumulations of shells collected into heaps or mounds. These mounds were long supposed to have been produced by natural causes, but comparatively recent investigations have shown that they are the remains of the festal or daily repasts of the ancient inhabitants. Thus their examination becomes an object of special interest; yet nothing had been done in this department of research in our own country until lately, when examinations were commenced by Professor Rau in New Jersey, Professor Wyman on the coasts of Florida, Maine, and Massachusetts, and by gentlemen connected with the Essex Institute, (now the Peabody Academy of Science,) in the vicinity of Salem, Massachusetts. During last summer, Professor Baird, of this Institution, after taking part in the Salem exploration, instituted an investigation as to the shell-heaps of the coast of New Brunswick. In this enterprise he received the voluntary assistance of Mr. G. A. Boardman, Dr. Todd, of St. Stephens, Mr. Josiah Simpson, of St. David's, and Dr. Parker, of St. Andrews. They examined several new depositories, which yielded unexpectedly large numbers of implements of horn, bone, and stone, together with the remains of the animals which had served as food. Of this exploration a full account will hereafter be prepared for publication in the report of the Institution.

Nor yet are lacustrian structures and shell heaps the only sources from which a knowledge of the manners and customs of pre-historic times may be acquired. The early inhabitants of almost every part of the world took advantage of natural caverns as places of shelter, and in these have left the indications of their former presence. An examination of the deposits of earth on the floors of these caverns, and sometimes even beneath the incrustations produced by the evaporation of the water charged with lime, which has dripped from the ceiling, have often disclosed the bones of men, and also artificial implements, mingled with the remains of extinct animals. A cave of this kind, in central Pennsylvania, was examined a number of years ago by Professor Baird, not with a view to the discovery of archæological remains, but those of the

animals which might have inhabited the cavern in previous geological periods. The débris which he obtained were carefully preserved, but not subjected to a critical examination. The Professor, however, has more recently resumed the investigation in the light which new facts have shed upon the connection of these caves and their contents with the character, the pursuits, and the condition of men in pre-historic times. An account of the result of these researches will also, in due time, be published.

The ethnological specimens we have mentioned are not considered as mere curiosities collected to excite the wonder of the illiterate, but as contributions to the materials from which it will be practicable to reconstruct by analogy and strict deduction the history of the past in its relation to the present. In the case of the remains of animals and plants, from which the geologist reconstructs the flora and fauna of ancient times, inferences are drawn from petrifactions, shells, bones and teeth. These, however, are not sufficient in the case of anthropology, and, in addition to the study of human skeletons and crania, recourse must be had to the relics of the works of the men of the past; to the remains of their houses, tombs, fortifications, temples, implements, and ornaments, in order to determine their relation to the races which now inhabit the earth. Ethnology, it must be admitted, is at present in an elementary condition: in the period through which all science must necessarily pass—that of the collection of material; and, consequently, the only deductions which can be drawn to-day are principally of a provisional character. It is true that the evidences in favor of the greater antiquity of the appearance of man on the surface of the earth than has been heretofore generally admitted have been accumulating from year to year, yet it can scarcely be said with fairness that the question is fully settled. Other hypotheses than those which have been advanced may be suggested to explain the facts observed. But, be this as it may, the investigation should be prosecuted without regard to preconceived views. We may rest satisfied that religion and true science cannot be at variance; the one properly understood, and the other rightly interpreted, must agree in final results. In short, we should follow the rule laid down by the Bishop of London in a lecture delivered at Edinburg, that: "The man of science should go on honestly, patiently, diffidently —observing and storing up his observations and carrying his reasonings unflinchingly to their legitimate conclusions, convinced that it would be treason to the majesty at once of science and of religion if he sought to help either by swerving ever so little from the straight line of truth." Care however must be taken that the provisional hypotheses of science are not mistaken for absolute truths, and premature attempts be made to explain discrepancies between the two great domains of thought, which, after (all, may arise from partial views of the connection of phenomena.

Museum, and care of specimens.—The exhibition rooms, to which the public generally have admission, have been limited since the fire to the large hall on the first floor of the main building, and the apartment on the same floor in the southern projection, the latter containing ethnological specimens of a large size, principally from Central America, the former, the general collection brought home by the Wilkes Exploring Expedition, and the large additions since made to it by the several explorations under the direction of officers of the general government.

It is greatly to be regretted that in the original plan of the building proper attention had not been given to the purposes to which it was to be applied. The spacious room, in which the rich collections of ornithology and ethnology are contained, presents to the eye a succession of large pillars which obstruct the view of the cases containing the specimens, and it is only by a separate examination of the contents of these cases that the value of the collections can be duly estimated. In fitting up the room of corresponding dimensions in the second story, an opportunity will be afforded of adopting arrangements far better suited for a comprehensive display of the vast number of objects with which in time it will be furnished.

During the past year, in addition to the rooms before mentioned, the west connecting range has been provided with cases for which the Institution is indebted to the Commissioner of Patents, and to which will be transferred, in the course of a few weeks, the ethnological specimens from China and Japan, a part of which are still in the Patent Office. It is intended to devote the whole of this room to ethnological specimens, especially those illustrating the dress of the different inhabitants of North America. The west wing of the building, previously occupied by the library, is temporarily appropriated to the alcoholic specimens, and to such other collections as are not of special interest to the general public; it is used also for storing duplicates for distribution.

For the support of the museum during the last year Congress appropriated $4,000, while the actual expense of the care and preservation of the collections, independent of the interest on the cost of the building, was upwards of $10,000. If to this be added only $10,000 for the rent of the apartments, it will be seen that the cost of the museum to the Institution cannot be estimated at less than $20,000 per annum.

The steady increase in the receipt of specimens has been maintained, and has fully equalled in number and value that of any preceding year. The different additions were from 186 different parties, and were contained in 308 boxes, 149 bundles, 19 jars and cans, 2 kegs, and 7 casks; 485 in all, inclosing many thousand specimens, a detailed notice of which will be found in the appendix to this report. It should be remarked that all these specimens are not intended to swell the number exhibited in the national museum, but that only the type specimens of such as are not already in the collection are to be devoted to this purpose, and the remainder made up into sets for distribution.

From the large accessions of specimens received during the year, much labor has been required merely to unpack, arrange, and catalogue them. The great importance should be borne in mind of prompt action in regard to affixing some permanent mark to each article so as to presevre all the data necessary to render it of value as material for scientific research. The locality and date of capture of every object of natural history, the name of the collector and donor, its association in place with other objects, its sex and age, are all points which can rarely be learned from the specimen itself and must be immediately recorded. This is done by affixing an ineffaceable number to the specimen and making an entry corresponding to that number in a bound record book kept in a fire-proof room. Whenever a specimen admits of it, the items above mentioned are marked upon the object itself, but as long as the numbers and records are in existence the identity of the article can always be verified and the facts in regard to it ascertained. The determination of the exact name of the specimen at the time of entry is a secondary matter, as the specialist can at any time ascertain this point from the internal evidence; the other data, being entirely those of association, cannot be ascertained in the same way.

Special attention has been given to the large ethnological collections belonging to the Institution, and considerable progress been made towards their permanent arrangement. The smaller objects, such as pipes, carved bones, stone implements, &c., will be mounted as soon as practicable on suitable tablets; all the older articles have been washed with a solution of carbolic acid, to destroy the mould produced by the water with which the building was deluged at the time of the fire, and such of the new ones as are liable to attacks from insects have been impregnated with poison. Each object of the collection will have the name of the donor, locality, &c., placed upon it, and the whole series will be completely arranged for study and exhibition during the present year. The principal work in this branch has been done under the direction of Prof. Baird, by Dr. E. Foreman and Dr. E. Palmer.

Other objects that have received attention in the way of rearrangement and improvement are those of human and other crania, shells, mounted birds, nests and eggs, &c., in which labor Professor Baird has been assisted by Dr. T M. Brewer, Dr. William Stimpson, Dr. E. Foreman, Mr. W. H. Dall, Mr. Zeledon, and Mr. R. Ridgway.

Among the most interesting collections received from abroad, in return for specimens presented by the Institution, may be mentioned a series of minerals and rocks from the K. Ober-Berg Amt, of Breslau, and a skeleton of the moose of Europe, from the zoological museum, Copenhagen. The latter will furnish the means of comparing the European variety with the closely allied if not identical moose of northern America. Of the living animals received from different parts of this country, it will suffice to mention a golden eagle, from Professor H. Shimer; a number of menopomas from Dr. Walker; gopher turtles from Dr. Wilson; and a

Rocky mountain salamander from Mr. J. C. Brevoort. It will be recollected that the living animals of a larger size heretofore presented to the Institution have been transferred to the National Asylum for the Insane, under the care of Dr. Nichols.

Distribution of specimens.—The distribution of duplicate specimens to public museums and in exchange has been prosecuted as extensively during the year as was compatible with the large additions continually coming in and requiring immediate attention. The surplus material of plants, shells, minerals, and fossils has been, however, to a considerable extent, made up into sets, and supplied as far as they would go to the parties having the first claim. Other collections, however, will be ready for similar distribution as soon as the investigations connected with them and their arrangement into sets can be completed. The great amount of labor required for this will be evident when it is recollected that every specimen sent out is numbered and accompanied by a label giving the name, locality, and donor. Professor Baird, who has the special charge of this branch of the operations, has been assisted in his labors by a number of young gentlemen, who having been engaged during the summer in explorations, avail themselves in the winter season of the facilities of the library, the collections, and apartments furnished by the Institution to prepare their reports for publication. Those who are at present rendering service of the kind above mentioned are Messrs. Meek, Dall, Palmer, Zeledon, Bannister, and Ridgway.

Agreeably to the resolutions adopted by the Board of Regents at its last session, that "the distribution of specimens to foreign establishments, carried on by the Smithsonian Institution, be continued and extended, but that at the same time proper returns be required," we have applied to the leading foreign museums which have been favored by our contributions for desiderata especially needed in this country, and have the assurance that in due time valuable collections will be transmitted to us from all parts of the world.

Among the establishments to which application has thus been made and a favorable response received, are: The British Museum and Royal College of Surgeons, London; Archæological Museum, Zurich; Public Museum, Berne; Museum of Lausanne; Academy of Sciences, and Botanical Garden, St. Petersburg; Royal Museum, Lisbon; Ethnological Museum, Moscow; Ethnological Museum of University of Christiania; Zoological Museum, Copenhagen; Zoological Museum of University of Berlin; Academy of Sciences and National Museum of Antiquity, Stockholm; Imperial Geological Institute, Vienna; University of Chile; Philosophical Society, Leeds; Ethnological Museum, Paris; Melbourne Museum, Australia.

Investigations.—It has always been the policy of the Institution to furnish specimens for special study and investigation to naturalists of established reputation, either in this country or abroad. The use of these specimens is

granted under the express condition that they are to form the subject of investigation, the results of which are to be published by the Institution or some other establishment, and that in all cases full credit is to be given to the Institution for the assistance it has rendered. Furthermore, in the case of the preparation of a monograph, a full set of the type specimens, correctly labeled, is to be put aside for the National Museum, and the remainder of the specimens made up into sets for distribution. The following list presents the more important cases of the loan or assignment of materials during the past year. Some of the specimens have already been returned, while the remainder are still in the hands of the parties to whom they were intrusted:

Crania of the recent and fossil bison, musk ox, &c., to Professor L. Agassiz, of Cambridge, Mass.; land shells of Central and South America to Thomas Bland, of New York; land and fresh water shells of North America to W. G. Binney, Burlington, N. J.; nests and eggs of North American birds to Dr. T. M. Brewer, Boston; birds of South America and Alaska to John Cassin, Philadelphia; Alcadæ of North America to Dr. Elliott Coues, United States army; collections of American and foreign reptiles to Professor E. D. Cope, Philadelphia; fungi from the Indian territory to the Rev. M. A. Curtis, Hillsborough, N. C.; unfigured species of North American birds to D. G. Elliott, New York; diatomaceous earths and deep-sea soundings to Arthur M. Edwards, New York; Lepidoptera from various North American localities to W. H. Edwards, Coalburg, Va.; seeds of Boehmeria, received from the Department of Agriculture, to Dr. Earl Flint, Nicaragua; plants collected in Ecuador by the expedition under Professor Orton to Dr. Asa Gray, Cambridge; miscellaneous specimens of North American insects to Professor T. Glover, Department of Agriculture, Washington; general collection of birds of Costa Rica and Yucatan to George N. Lawrence, New York; American Unionidæ to Isaac Lea, Philadelphia; series of North American salamanders to St. George Mivart, London; American Diptera to Baron R. Ostensacken, New York; Lepidoptera of Ecuador and Yucatan to Tryon Reakirt, Philadelphia; plants collected in Alaska by various expeditions to Dr. J. T. Rothrock, McVeytown, Pa.; birds of Buenos Ayres, received from W. H. Hudson, and a series of small American owls, to Dr. P. L. Sclater and Osbert Salvin, London; miscellaneous collections of American Orthoptera to S. H. Scudder, Boston; collections of American Hemiptera to P. R. Uhler, Baltimore; American myriapods and spiders to Dr. H. C. Wood, Philadelphia; human crania from northwestern America and the ancient mounds of Kentucky, also collections from the ancient shell-heaps of Massachusetts and New Brunswick, to Dr. Jeffreys Wyman, Cambridge.

Few persons are aware of the great extent to which this Smithsonian material has been used by American and foreign naturalists, or the number of new facts and new species which have been contributed to natural history through its means. A complete bibliography of the titles

of the various books and memoirs containing in part or entire the results of these examinations, with lists of the new species, would form a large volume. Among the published results of the examination of the materials furnished by the Institution during the last year may be mentioned the following:

A monograph of the Alcadæ, by Dr. E. Coues, in the Proceedings of the Philadelphia Academy of Natural Sciences; various herpetological papers in the same Proceedings, by Professor E. D. Cope; portions of various fasciculi of his work on North American birds, by D. G. Elliott; monograph of the North American Lepidoptera, by W. H. Edwards; catalogue of the birds of Costa Rica in the museum of the Smithsonian Institution, and some special papers in the annals of the New York Lyceum of Natural History and the Proceedings of the Philadelphia Academy, by George N. Lawrence; paper on the Unionidæ in Proceedings Philadelphia Academy, by Isaac Lea; monograph of the North American Diptera, Part IV, by Baron R. Ostensacken, published by the Smithsonian Institution; catalogue of Alaskan plants in the Report of the Smithsonian Institution for 1867, by Dr. J. T. Rothrock; list of birds sent from Buenos Ayres to the Smithsonian Institution, and other papers, in the Proceedings of the Zoological Society of London, by Dr. P. L. Sclater and O. Salvin; "on crania of Tschuktchi and Esquimaux tribes," by Professor J. Wyman, in the Proceedings of the Boston Society of Natural History. In all these cases full credit is given for the aid which has been afforded by the Institution.

The Secretary, during the past year, has given a large amount of thought and labor to investigations relative to light and sound as aids to navigation, in connection with his duty as one of the members of the United States Light-house Board. He has also, in his connection with the National Academy of Sciences, devoted nearly all his time, for the space of two months, to investigations relative to the proper form of meters for gauging the quantity of proof spirits produced by distilleries, in order to determine the amount of tax to be paid to the government.

Professor Baird has continued his investigations relative to the birds of North America, especially those of Alaska, the result of which has been the addition of fifteen species to those previously known to exist in this country. He has also edited a report by Dr. Cooper on the birds of California, for the geological survey of that State under Professor J. D. Whitney, and is now engaged in the preparation of a new manual of the ornithology of the United States. This work, which is to be illustrated by numerous engravings on wood, will be published by Little & Brown, of Boston, in the course of next year.

Exchanges.—The cost of the international system of exchanges in the transportation of books and specimens is constantly increasing, and now forms no inconsiderable part of the annual expenditures. Were it not for the liberality of various companies, we should be unable to con-

tinue the system, at least in its present dimensions; and we embrace this occasion again to express acknowledgments for the efficient aid thus rendered to the cause of science and to the promotion of kindly feeling between the United States and the other nations of the world. The following are the companies to which special thanks are due, namely, The Pacific Mail Steamship Company, North German Lloyd. Hamburg American Steamship Company, General Transatlantic Steamship Company, Pacific Steam Navigation Company, Inman Steamship Company, Cunard Steamship Company, California and Mexico Steamship Company, and Panama Railroad Company. To this list must be added several other lines which have granted similar facilities during the past year, namely, the Mexican Steamship Company, Union Pacific Railroad, United States and Brazil Steamship Company, North German Lloyd, (Baltimore line,) and the Atlantic Mail Steamship Company.

Acknowledgments are also due for favors rendered in connection with foreign exchanges to E. J. Davison, esq., Argentine consul; José I. Sanchez, esq., consul of Venezuela; Señor B. Blanco, consul-general of Guatemala; L. H. J. d'Aguiar, consul-general of Brazil; R. C. Burlage, consul-general of Netherlands; Hon. E. Gutierez, minister from Costa Rica; to the American Board of Commissioners of Foreign Missions; Real Sociedad Economica, Havana; Board of Foreign Missions, New York; American Colonization Society, Washington; Society of Geography and Statistics, Mexico; University of Chili; Bataviaasche Genootschap, Java; Institute of History, Geography, and Ethnology, of Rio Janeiro.

The Institution frequently receives applications from foreign governments and societies for official publications of the States or general government relative to certain branches of political economy, statistics, education, &c. During the last year a request of this kind was received from the Belgian government, desiring us to procure all the publications of the States in regard to public schools. In answer to our circular asking for these documents, a large and valuable collection was received, for which the thanks of the Institution were returned to the following persons, namely: to A. Rogers, second auditor of Virginia; T. Jordan, secretary of state, Pennsylvania; S. C. Jackson, assistant secretary Board of Education, Massachusetts; J. A. Morris, school commissioner, Ohio; N. Bateman, superintendent education, Illinois; C. J. Hoadley, state librarian, Connecticut; F. Rodman, secretary of state, Missouri; R. A. Barker, secretary of state, Kansas; Ed. Wright, secretary of state, Iowa; C. W. Wright, secretary of state, Delaware; J. E. Tenney, secretary of state, Michigan; and the secretary of state, Wisconsin.

Another application of a similar character was received from the government of Norway for the publications of the United States relative to military affairs, which, on being referred to the heads of departments and bureaus, secured a large number of the desired publications. Acknowledgments for these favors are due to General E. D. Townsend, adjutant general; General A. A. Humphreys, chief engineer United

States army; Surgeon General Barnes; Paymaster General Brice; General Dyer, chief of ordnance; Commodore Jenkins, chief of bureau of ordnance and hydrography, Navy Department; General Myer, chief signal officer.

For official co-operation with the Institution in its various plans for the promotion of knowledge and important assistance rendered, besides the foregoing, we may mention Hon. William H. Seward, Secretary of State; Hon. Hugh McCulloch, Secretary of the Treasury; Hon. Horace Capron, Commissioner of Agriculture; General Meigs, Quartermaster General; Mr. Spofford, librarian of Congress; Professor J. H. C. Coffin, superintendent Nautical Almanac; and Commodore Sands, of the National Observatory.

In 1867 a proposition was made to the Institution by the librarian of Congress relative to establishing and conducting a system of exchange of official documents between the government of the United States and those of other nations. In accordance with this, a circular was addressed to the different governments having relations with the United States for the purpose of ascertaining their views as to such an exchange. In every case the proposition was regarded with favor, and at the ensuing session of Congress an act was passed directing that 50 full sets of all documents published at the Government Printing Office should be set apart for the purpose in question, and appropriating a sufficient sum to defray the necessary expenses. Unfortunately, however, Congress neglected to direct the public printer to strike off the necessary copies for this purpose, in addition to the regular number previously required for the use of the government, and it was not until recently that the necessary legislation was procured to remedy this omission. As soon as the printing of the documents of the present session of Congress is completed, the exchange proposed will be initiated. In anticipation of the receipt of the annual supply of the documents of our government, several large packages containing documents of foreign countries have been already received.

At the commencement of the system of international exchanges, great delay and considerable expense were incurred in consequence of custom-house requirements and tariff duties, but as the importance of the system became more evident, and the reputation of the Institution better established, one government after another consented to the entrance of packages without examination and free of all restrictions, until at the present time there is no exception to this practice.

The first effort towards the establishment of this desirable condition of free intercourse was made in 1852, through Sir Henry Bulwer, then minister from Great Britain to the United States. Through his recommendations the British authorities at first permitted the entry of such books from the Institution intended as presents to learned bodies as might be recommended for that privilege by the Royal Society of London. This, though an important concession, was still attended with consider-

able delay, and on further solicitation the rule was so relaxed that at present the Smithsonian agent finds no difficulty in obtaining the passage of the packages at a mere nominal charge through the custom-house. With the precedent of the British authorities the Institution experienced no difficulty in making a satisfactory arrangement with the French officers of customs. Packages for Germany and central Europe, addressed to our agent, Dr. Flugel, are entered at Bremen or Hamburg, then transferred to the Leipsic custom-house, from which they are released on the formal application of the agent to the authorities of the Zolverein. Parcels for Belgium and Holland are entered at Amsterdam, which is a free port. Those for Italy are entered at Genoa, which is also a port of free entry. In all cases of transmission of packages an invoice of the contents is sent to the agent, which serves as the basis of his application for remission of duties and charges.

Library.—The works which have been received from all parts of the world in return for the Smithsonian publications, after being recorded at the Institution, have been transferred to the national library in accordance with the rules given in former reports. They are there under the care of an accomplished librarian and a corps of able assistants, accessible to all persons who desire to consult them, during every weekday of the whole year, with the exception of a month in summer. The transfer of the library of the Institution still continues to be approved by all who have attentively considered the advantages it affords to the Institution, the government and the public. It has relieved the Smithson fund of a serious burden in the cost of binding and cataloguing the books, in the pay of a librarian and his assistants, and in the expense of the maintenance of a separate establishment. It has enriched the library of Congress with a class of valuable works which could scarcely be procured by purchase, and it has facilitated the use of the books by collecting them in one locality, under the same system, readily accessible to the public. Some special works required for immediate use are still occasionally purchased, and besides these a working library is retained at the Institution, principally, however, of duplicate volumes, while such series as are needed for special investigation are brought back for the purpose. The care of these and the cost of those purchased make up the small expenditure given in the report of the executive committee under the head of the library.

The Library of Congress, or, as we think it should now be denominated, the "National Library," contains about 180,000 volumes, exclusive of unbound pamphlets and periodicals, and is rapidly increasing, the accessions during the year ending December 1, 1868, according to the report of Mr. Spofford, the librarian, amounting to 8,498. This library is emphatically a library of progress, for while it continues to increase by purchase in its own series of standard works of all times, its additions, through the contributions to it of the Institution, include the trans-

actions of the principal learned societies of the world, or the works which mark more definitely than any other publications the actual advance of the age in higher civilization.

An idea has, in some cases, been entertained abroad that the Institution, since the transfer of the library, no longer desires to receive books, but measures have been taken to counteract this impression and to assure Societies and other correspondents that no change in this respect has taken place in the policy of the Institution, and that books on all subjects are still desired both for its own collections and for presentation to other establishments in this country.

The following is a statement of the books, maps, and charts received by exchange in 1868:

Volumes:		
Octavo	1,316	
Quarto	394	
Folio	60	
		1,770
Parts of volumes and pamphlets:		
Octavo	2,565	
Quarto	761	
Folio	279	
		3,605
Maps and charts		134
Total receipts		5,509

The following are some of the larger donations received in 1868:

From the Royal Northern University, Christiania, 24 volumes and 27 pamphlets.

The Royal Society of Northern Antiquaries, Copenhagen, 9 volumes and 8 pamphlets.

The Imperial Academy of Sciences, St. Petersburg, 25 volumes and 27 pamphlets.

From His Majesty the King of Prussia, "Kunstdenkmäler des christlichen Mittelalter in den Rheinlanden," 1st part, vol. iii. "Preussen's Schlösser und Residenzen, von A. Duncker," vol. ix, and "Scriptores Rerum Prussicarum," vol, iii; all in continuation of works previously sent.

The Hungarian Academy of Sciences, Pesth, 51 volumes and 178 pamphlets.

The Ducal Library, Oldenburg, 34 volumes, consisting of a series of state calendars and other statistical works.

From J. G. Cotta, Augsburg, 11 volumes:

From H. De Saussure, Geneva, 10 volumes and 13 pamphlets:

From the Chamber of Commerce, Bordeaux, 7 volumes:

The Société Imp. des Sciences, de l'Agriculture et des Arts, Lille, 12 volumes of "Memoires:"

The Société d'encouragement pour l'Industrie Nationale, Paris, 14 volumes "Bulletin:"

The Société Imperiale et Centrale d'Agriculture, Paris, 26 volumes "Memoires," 12 volumes "Bulletin."

From the Museum de Douai, 11 volumes and 15 pamphlets: consisting principally of transactions and proceedings of societies.

National Library, Madrid, 12 volumes and 15 pamphlets.

The Meteorological Office, London, 6 volumes, 37 pamphlets, and 16 charts.

The Hydrographic Office, London, 6 volumes, 10 pamphlets, and 43 charts, giving the results of the latest maritime surveys.

From the National Library of Greece, Athens, 112 volumes and 39 pamphlets, principally on the philosophy and literature of ancient Greece.

Thomason College of Civil Engineering, Rourkee, 13 volumes and 44 pamphlets.

Royal Asiatic Society (North China branch) Shanghai, 4 volumes "Journal."

Library of Parliament, Melbourne, 10 volumes and 14 pamphlets.

Real Sociedad Economica de la Habana, 630 volumes, 13 pamphlets, and 1 chart.

University and Government of Chili, Santiago, 58 volumes, 13 pamphlets, and 30 charts.

Massachusetts State Library, 11 volumes.

Ohio State Library, 10 volumes.

Vermont State Library, 11 volumes.

But, perhaps one of the most interesting contributions is a work relative to history and philology published in folio parts of fac-similes of the national manuscripts of England, presented by Right Honorable the Secretary of State for War. These fac-similes are executed with minute precision as to accuracy, by the photozincographic process, under the direction of Colonel H. James of the ordnance department. The series includes documents belonging to each reign, from William the Conqueror to Queen Anne, arranged chronologically so as to illustrate the changes in the handwriting, and the language of different periods of English history. A translation is given of each document into modern English, together with a short account of its history. The first volume extends from William the Conqueror to Henry VII, and includes autographs of each sovereign, beginning with that of Richard II, and of many princes, prelates and nobles, whose names have become famous in history. Among the number are a series during the reign of Richard III, and several from the king himself.

The second part is made up of fac-similes selected from the public records of the reigns of Henry VIII and Edward VI. Among them are holograph letters, and autographs of Henry VIII, Queen Catharine of Aragon, Cardinal Wolsey, the Emperor Charles V, Anne Boleyn, Archbishop Cranmer, Queen Catharine Parr, Ann of Cleves, &c. The

third part contains fac-similes of state papers, royal letters, and other documents, both public and private, belonging to the reigns of Queen Mary and Queen Elizabeth. Among those of the former are autographs of her Majesty and of her cousin and rival, Lady Jane Grey, holographs and autographs of King Henry the Second, of France, the King of Hungary Cosmo de Medici, the Lady Elizabeth of England, Thomas Gresham, Roger Ascham, &c. Among those of the reign of Queen Elizabeth, besides those from herself, are letters of Mary Queen of Scots and her husband Bothwell, and of the most distinguished nobles of Scotland; of John Knox, Sir Humphrey Gilbert, James VI of Scotland, Sir Francis Vere, Sir Walter Raleigh, and other celebrated personages. The exaggerated terms of courtesy which were in use among eminent personages at that period are illustrated by several examples in this volume. The publication of the fac-similes of these valuable and interesting documents is to be continued, and we learn from the preface that similar fac-similes of the national manuscripts of Scotland have been undertaken, and those of Ireland recommended.

It may be proper to recall the fact that the library of Smithson, or so much of it as was received by the Institution, with his personal effects, was not destroyed by the fire, and has been placed in a suitable case for permanent preservation.

Mr. Theodore Gill, who was formerly assistant in the library of the Institution, has been appointed one of the principal assistants in the national library, but he still continues his investigations in natural history at the Institution, and acts as the intermediate agent between the two establishments. Miss Jane Turner, who vindicates by her accuracy and efficiency the propriety of employing her sex in some of the departments of government, still continues to register the books as they are received through the extended system of international exchange.

Gallery of Art.—The original act of Congress organizing the Institution directed that, in addition to the support of a museum, library, &c., provision should also be made for a gallery of art. In compliance with this direction a commencement was made by the purchase of a series of valuable engravings, illustrative of the progress of the art from the earliest times, and also a series of Indian portraits was received on deposit. With these and a number of plaster casts of distinguished individuals, principally donations, a collection of articles was formed to which the name of a gallery of art was given. The Indian portraits, which had been deposited by the author, Mr. Stanley, together with a series of portraits also of Indians, belonging to the government, were destroyed by the fire. Fortunately the engravings, with few exceptions, were saved, and are now deposited with the books in the library of Congress. It was evident, however, that the proportion of the Smithson fund which could be devoted to the purchase of specimens of art worthy of preservation in a public gallery at the seat of government was far too small to do anything of importance in this line. It was therefore with

gratification that the Regents learned that a citizen of Washington, William W. Corcoran, esq., with an enlightened liberality, commensurate only with his means, had resolved to found an institution exclusively devoted to art. This design, which would otherwise have long since been fully carried out, was interrupted by the war. The large building which Mr. Corcoran had erected for the purpose was found necessary by the government for the use of the Quartermaster General and is still retained in possession of that officer. As soon as possession of it is restored to Mr. Corcoran, which it is believed will be done in the course of the present year, it, together with a liberal endowment equal in amount to the original fund of Smithson, will be given in charge to a board of trustees, who will immediately proceed to carry out the views of the generous founder. In accordance with the policy which the Institution has adopted in regard to the library of Congress, the Agricultural Department, and the Army Medical Museum, it will probably be considered advisable to enter also into friendly co-operation with this new establishment, and instead of attempting to support a separate gallery of art to turn over to it the articles which have already been collected, and thereby increase the space in the Smithsonian building for articles of natural history and ethnology.

Meteorology.—It was stated in the last report that with the diminished expenditure on the building, and the larger amount which could be appropriated to the active operations of the Institution, the reduction and discussion of the meteorological material which had been collected for 20 years would be resumed, and that we had commenced upon the rain-fall of the North American continent. Observations relative to this subject from upwards of 1,200 localities were placed in the hands of the computers. This work has been completed under the direction of Mr. Charles A. Schott, and will be put to press as soon as the illustrations are engraved. We are confident it will be considered by all who are competent to properly estimate its value, as one of the most important additions to the climatology of North America and the agricultural interests of the community which has ever been made. The same computers are now engaged upon the large amount of material relative to temperature, but the reduction and discussion of these will require more time than that which has been devoted to the rain-fall. It is estimated, however, that at the rate at which the work is now going on, it will be completed in the course of the next year.

The discussion of all the observations relative to the winds has been resumed under the direction of Professor J. H. Coffin, of Lafayette College, Pennsylvania, and will be prosecuted with as much rapidity as the nature of the subject, and the assistance afforded him, will permit.

All the more important meteorological observations which have been collected at the Institution during the last 20 years, are now in process of reduction, and when completed and the results published, we think

they will fully justify the expenditure of the Smithson fund which has been devoted to this subject.

The importance of a thorough knowledge of the climate of a country in relation to the well-being of the inhabitants can scarcely be overestimated. The character of the animal and vegetable productions of any part of the world mainly depends on the climate, and if, as in geological periods, we suppose this in any case to undergo a change, we are certain, from the operation of general laws, that the fauna and flora of the region will undergo a corresponding change. It is true that civilized man has in a degree, through science, the power of resisting the influence of climate to which his race has not been long subjected, yet if sufficient time be allowed for the weather to produce its effect, marked peculiarities of physical constitution and even mental characteristics will eventually be produced, though these will be somewhat modified by the artificial conditions which have been introduced. Even a difference in the degree of moisture of the atmosphere has been shown by a critical observer to induce marked changes in the manners and customs of Europeans in their emigration to this country.

The average temperature and moisture of each region, as well as the periodical fluctuations to which these elements are subjected, are essential data on which to base the choice of special objects of culture and to estimate the probable results as to success or failure in a given number of years. It is a fact to which the statesman and the intelligent farmer cannot be too much alive, that the great material prosperity of this country in the past has been due to the large quantity of fertilizing material originally in the soil, and that this has been exhausted to a far greater extent than is generally supposed. It is well known that the same soil which in the eastern States originally yielded 30, and in some cases 40 or 50 bushels of wheat to an acre, now produces but eight or ten. From a late estimate by the Commissioner of Agriculture the average yield of the whole United States is less than 12 bushels, while that of Great Britain is 28; the great excess of the latter over the former must be mainly due to the improved methods of agriculture. Indeed with the large extent of virgin soil in this country, producing spontaneously rich harvests, with the expenditure of a minimum amount of labor, we have had comparatively little necessity to adopt methods of scientific agriculture, but we have now arrived at the condition in which every year a new demand will be made for the application of knowledge and skill of this kind, and for all the light which can be shed upon the subject by meteorology, chemistry, physiology, and other branches of science.

It will be remembered that the meteorological system of the Smithsonian Institution was in a considerable degree interrupted, particularly in the southern States, on account of the late war. We have, however, during the past year succeeded in obtaining a number of copies of registers which were continued with but little interruption through the whole

period of the disturbance, and have also supplied a deficiency occasioned by the loss of the registers of 1860 in the fire which occurred at the Institution in 1865. For the purpose of exhibiting the extent of the material in possession of the Institution, and to give credit to the faithful and persevering observers who have so long gratuitously furnished contributions to this branch of science, there is given in the appendix to this report a full list of all the observers and of all the stations where records have been made from the beginning of the year 1849 to the end of 1868. The whole number of observers at present reporting to the Institution is about 400; of these 74 are furnished with full sets of instruments. The number of observers under the direction of the army is upwards of 100, of whom 50 are supplied with standard barometers and other compared instruments. With this combined system, interspersed with full sets of standard instruments, trustworthy data is obtained for determining the general climatology of the country. It is true that many of the instruments in use are not as perfect as could be desired, yet they serve to indicate differences in the elements, and thus afford the data for tracing the progress, as it were, of waves of atmospheric pressure, and also of waves of changes in atmospheric temperature.

Anticipating the important benefits which may result to our system of meteorological observations, particularly to those which relate to the prediction of storms on the Atlantic coast, we look forward with much interest to the completion of the Pacific railway. A well equipped physical observatory placed at the highest point of the road, namely, "Sherman's station," is very desirable, and we think it probable that assistance from the railway company may be obtained to establish and support an observatory of this character.

During the past year a large number of rain gauges of a simple form, such as were mentioned in the last report, have been procured and distributed to observers in various parts of the country. This gauge consists of a hollow cylinder of tinned iron $2\frac{1}{2}$ inches in diameter, and 12 inches in height, coated inside and out with varnish to prevent rusting. The depth of rain is measured by inserting a graduated scale into the gauge, and noting the height to which it has been wetted, in tenths and parts of tenths of an inch. The quantity of water in a fall of snow is measured by melting a column equal in diameter to that of the gauge. This is obtained by pressing the gauge, mouth downward, through the snow to the ground and isolating the contents by passing under the mouth of the gauge a thin plate of metal. A rain gauge of this form, after an experience of many years, is found to give the most satisfactory results when used by ordinary observers.

The discussion of all the material which we have collected in regard to rain-fall, has served to point out the parts of the country in which the registration is most deficient, and exertions have especially been made to obtain observations from the great plains of the west and at the base of the Rocky mountains. The great current of the return trade wind,

which continually flows through the higher regions of the atmosphere over the whole United States and which at intervals reaches the surface of the earth, deposits its moisture, obtained from the Pacific, on the Sierra Nevada and other chains of the Rocky Mountain system, and thus gives rise to the arid basins and woodless plains of the western portion of our domain. A part, however, of this region may be rendered arable by means of irrigation, or, in other words, a portion of the precipitated vapor may be, as it were, reclaimed for agricultural purposes, by artificial means; and in determining the available resources of the country it is important that the amount of water, either in the liquid state or in the form of snow, which is precipitated in the mountains, should at least be approximately determined, and hence we have directed special inquiries to this point, supplying rain-gauges in all cases of explorations and giving definite directions as to ascertaining the depth of snow, the gauging of streams, &c.

Much has been written on the subject of reclaiming arid wastes by planting trees, but the facts which have been collected in regard to this matter are frequently misinterpreted, and the result of much research in reference to it misapplied. It should be recollected that trees cannot grow without moisture and that they have no power within themselves to create this essential element of their existence. It is true that in some cases where moisture exists but is retained in an aeriform condition by the radiating character of the soil, or carried away by the wind, it may be precipitated and rendered applicable to the uses of agriculture by the judicious planting of trees; while it is equally true that there are other localities in which the necessary water for vegetation can never be procured by artificial means. The necessary data for the investigation of this question in relation to the western portion of the great valley of the Mississippi can only be obtained by extensive series of observations on the relative humidity and the direction of the moisture-bearing winds of different portions of the country.

During the past year a self-registering barometrical apparatus, invented by Professor George W. Hough, of the Dudley Observatory, has been erected in the Institution, but owing to the position in which it was first placed the series of records has not been continuous, though from the records which have been obtained it would appear that the instrument is capable of giving valuable results. This instrument consists of an iron tube in the form of a siphon closed at the upper end and filled with mercury, and two cylinders or drums moved by clock work, to the surface of which is attached the paper receiving the register. On the surface of the mercury, in the shorter leg of the siphon, is an ivory float, fastened by a fine thread to one end of a lever, the other end of which terminates between two points connecting the opposite poles of a galvanic battery. As soon as the mercury begins to rise and while it continues to ascend, the end of the lever is pressed against the upper point, thus completing the circuit of an electro-magnet, which unlocks

the printing part of the machine, and a record is made in the form of an ascending curve on the drums and on a slip of paper in figures, on the principle of the printing telegraph. When the mercury falls the motion of the pencil is reversed by bringing into operation a second electro-magnet by which is traced a descending curve. Two drums are used, one giving the curve for two weeks and the other the same more developed for two days, the one serving as a check on the other. An interesting series of observations furnished from the United States engineer depot at Willett's Point, New York, by General Abbot, exhibits the almost perfect parallelism of two curves for nearly a month, one by an apparatus similar to this at Albany and the other at Willett's Point, from observations with an ordinary standard barometer, the distance between these places being upwards of a hundred and fifty miles. The parallelism of these curves exhibits not only the probable accuracy of the self-recording apparatus, but also the extent in a north and south direction of a wave of atmospheric pressure. The great improvement in meteorological data must depend in future on the introduction of self-recording instruments, especially at important points.

Beside the contributions made directly from the ordinary observations of the Institution, the following is an acccount of a memoir belonging to meteorology, previously noticed under the head of publications:

On the evening of July 20, 1860, a meteoric fire-ball passed over the northern parts of the United States and the adjacent parts of Canada, of so extraordinary a brilliancy as to attract the attention of numerous observers along its entire visible track of nearly 1,300 miles. The phenomenon was of so interesting a character that the Smithsonian Institution made exertions to collect observations in regard to it from its meteorological observers and other correspondents, which, together with accounts from newspapers and other sources, were placed in the hands of Professor Coffin, of Lafayette College, for the determination of the orbit of the meteor. In order to correct the observations, in cases where instruments could not be obtained, Professor Coffin directed that estimates should be made of the position of the meteor, by means of an extemporaneous quadrant, consisting of a graduated paper attached to a board, from an angle of which a small plumb-line was suspended. The edge of this instrument being directed to the place in the heavens where the meteor was seen at its greatest elevation, gave approximately the angle of altitude. The meteor was first observed moving from a point over the western shore of Lake Michigan, though it is not improbable that it became luminous when it was somewhat further west, as the sky in that region was obscured by clouds, and it was not until it had reached a point 150 miles further east that the first reliable observation of its position was made; from this point many eyes watched its course, until it disappeared out at sea, in a southeasterly direction, beyond the island of Nantucket. Whatever may have been the orbit of this meteor before it became visible, it is obvious that the portion of the path that

was subject to observation was so near the earth as to be controlled almost entirely by its attraction, and not sensibly perturbed by other bodies. The orbit therefore ascertained, is not the path of the meteor in space, but that having the center of the earth in one of its foci. Professor Coffin proceeded with the data at his command, to determine the path upon the assumption that the earth was a sphere 7,912 miles in diameter, not taking into account its spheroidal form, nor the difference between the true and the apparent zenith. In prosecuting the investigations, the method adopted was as follows: The parallax and position of the meteor were obtained by combining in pairs observations taken on or near the same vertical plane. Unfortunately, the number of pairs of reliable observations was too few for much accuracy. An approximate orbit was, however, determined, from which azimuths and altitudes were deduced, and these compared with those given by the observations. The form of the orbit was then altered so as to diminish the discrepancies, and it was not until over fifty changes of this kind had been made that the final result was attained. The velocity per second, relative to the earth's center, which best corresponded with observations, was nine and three-fourths miles. The first approximate orbit satisfied the most reliable observations west of about longitude 76° or 77°; but further east the discrepancies were so great that they could be reconciled only by a sudden change in the curvature of the path, one at the point just named, and another two or three degrees further east. In the vicinity of the former of these points a remarkable rupture in the body of the meteor was observed, where it separated into two parts that appeared nearly of equal size, thus affording a rational explanation of the change in the elements. That a change should take place at a point of explosion was not difficult to understand, but the fact that the meteor descended quite rapidly towards the earth, until it reached the meridian of 74°, and afterwards rose, was difficult to comprehend. The most plausible explanation was suggested by Professor Lyman, viz: that the change in direction was due to the increased resistance of the air as the meteor descended into a denser portion. An attempt was made to deduce the quantity of the change from this hypothesis; the result, however, was not entirely satisfactory, an empirical change being assumed in the path near longitude 74°. An orbit was computed, the path of the meteor divided itself into three sections, the first and last of indefinite length, through only a small portion of which the meteor was visible; the other an intermediate portion of 160 miles in length, where it was most brilliant. The most important omission in the calculation of the elements of this meteor, according to Professor Coffin himself, was that of the spheroidal form of the earth, which became of importance in comparison with the small height of the meteor; but with the hope that the subject might hereafter receive at the hands of others a more thorough discussion, he concluded to slightly modify the elements, so as to afford an unperturbed orbit that would differ so

little from the disturbed one, that the azimuths and the altitudes which he had already computed for the one might serve for the other. The velocity of the meteor, when nearest the earth, was 9.76 miles per second; its least distance from the surface of the earth was 39.19 miles, at about the middle of New York.

Correspondence.—As the collaborators of the Institution generally reside at a distance, the business with them is principally carried on by mail. The same is also the case in regard to all the exchanges, and consequently the record of nearly all the transactions of the Institution is contained in the correspondence. Besides those relating to official business, hundreds of letters are received during the year, containing inquiries relative to the various subjects on which the writers desire information. If these cannot be immediately answered without much research, they are referred to collaborators who are experts in the various branches of knowledge, and who can readily supply information in regard to subjects within the range of their special studies.

In addition to the foregoing it may also be mentioned that there are four hundred meteorological observers, from each of whom several letters are received annually. The correspondence of the Institution being of such importance, it has been considered necessary to adopt a system in regard to it, which consists in registering in a book prepared for the purpose, every letter received which pertains to the business of the Institution. The mail is opened every morning by an assistant, who assigns to each letter a number, gives a synopsis of its contents, and notes to whom it is referred for answer. The letters are afterwards bound in volumes and indexed. Press copies are kept of all the answers. An idea may be formed of the amount of labor bestowed upon this branch of operations, when it is mentioned that the number of letters registered during 1868 was 5,141. This does not include letters acknowledging the receipt of donations from the Institution, which would swell the number of actual receipts by the mail to upwards of 10,000.

During the past year references of inquiries above referred to have been made to the following gentlemen: Dr. Torrey, of New York; Professors Gray and Wyman, of Cambridge; Dr. Leidy and Mr. Isaac Lea, of Philadelphia; Professors Whitney, Brush, and Newton, of New Haven; Drs. Woodward, Otis and Craig, of the Surgeon General's office; Prof. Schaeffer and Mr. W. B. Taylor, of the Patent Office; Professor S. Newcomb, of the Naval Observatory; and Mr. George Gibbs and Mr. J. H. Lane, of Washington.

Grounds.—The Smithsonian building, as is well known to the visitors of Washington, stands in the midst of a park, adorned with a collection of the principal ornamental trees which are susceptible of cultivation in this climate. This forms part of a reservation of the government denominated the "Mall," extending from the Capitol to the Potomac,

which, in accordance with the design of Mr. Downing, was to be entirely devoted to an extensive park.

This plan has been revived by the present Commissioner of Public Buildings, General Michler, of the United States army, who strongly advocates an appropriation for carrying it into execution. On the grounds adjoining the Institution to the west, also a part of the proposed park, within the last year a spacious building has been erected for the uses of the Department of Agriculture, and designs have been made under the present Commissioner, General Capron, for the establishment of an extensive arboretum. With the renewed interest which has been excited on this subject, and the rapid advance of the city in wealth and population, we doubt not the original plan will soon be realized. In the mean time, however, we would call attention to the fact that many of the valuable trees originally planted by Downing are being injured by the luxuriant growth and consequent crowding of those too near each other. Though the visitors to the Institution—and the number of these is by no means small in the course of a year, and from every part of the world—are delighted with the general appearance of the grounds and the picturesque effect of the building, yet their sense of propriety is shocked and their olfactory nerves outraged, in approaching the building from the city, by having to cross that most disgusting object known as the "canal," though for years it has done no service of any value in that capacity. It is, in fact, a Stygian pool, from which are constantly ascending in bubbles, as from a caldron, mephitic vapors. That part of it which bounds the Smithsonian grounds and those of the Agricultural Department, on the north, consists of a basin 150 feet wide, extending from Seventh street to Fourteenth street. Into this is poured most of the excrementitious matter of the city, which is suffered to decompose into offensive gases, and exposes with each ebb of the tide a mass of the most offensive matter conceivable. This subject, at the last session of the Board of Regents, was referred to the executive committee, who have given it special attention, and prepared a report which will be presented to the Board at the present session, and should be ordered to be published.*

The only reason assigned for suffering this nuisance to remain so long unabated is the difficulty of settling upon a plan of remedying the evil, but surely this need not longer to stand in the way since there is engineering ability enough in the country to solve problems of greater intricacy than the one under consideration. The only effectual cure of the evil is, in my opinion, to fill up the present basin, and construct a covered sewer of sufficient capacity to receive that part of the drainage of the city which cannot be turned in other directions. A wide street with concave surface to discharge very rare freshets, would afford a series of building lots of sufficient value to pay the

* This report will be found in the journal of proceedings of the Board of Regents in this volume.

expense of the improvement, while the value of property south of the canal would be greatly enhanced.

Before concluding this sketch of the history of the operations of the Institution for the year 1868, it becomes my duty to mention the death of Mr. William B. Randolph, who for many years has acted as book-keeper for the Institution, posting and auditing its accounts, and who for 60 years had been connected with the Treasury Department of the government. He was a gentleman of extensive information, a graduate of Princeton College, of inflexible integrity, esteemed and beloved by all who knew him. His life was prolonged with vigor of intellect beyond the usual term of earthly existence, and he died on the 15th of May last at the age of 81.

Since the death of Mr. Randolph the entire charge of the accounts has been given to the chief clerk, Mr. William J. Rhees, by whom they are prepared for quarterly examination by General Delafield and Dr. Parker, of the executive committee.

In conclusion, from all the facts which have been given in this report, as well as in previous ones, we think it may reasonably be claimed that the administration of the Smithson fund, on the whole, has been successful. Though the Institution has been subjected to loss by casualties, and has been exposed to adverse conditions during the most troublous times in the history of the na'ion, yet it has continued noiselessly and unostentatiously to extend its influence and benefits not only to every part of this country, but to all portions of the civilized world. This success, if mainly due to the definiteness of conception in the original plan, must, in no small degree, be attributed to the fact that the Chief Justice of the United States is the head of the Board of Regents, whose permanence of office, aside from other considerations, could not fail to secure, as has been conspicuously evinced in the case of both Judge Taney and Judge Chase, a warm and intelligent interest in the affairs of the Institution. Neither is it possible to overlook, in this connection, the favorable influence of the policy which, from the first, has invested in a single officer, the Secretary, the executive charge of the operations, thus confiding to him their conduct and rendering him responsible for their results, without in a single case interfering with his acts. Moreover, simple justice would require that due credit should be given to the capable and zealous assistants whom the Secretary has associated with himself in carrying on the multifarious and arduous duties of his office.

Respectfully submitted.

JOSEPH HENRY.

WASHINGTON, D. C., *January*, 1869.

Appendix to Secretary's Report, 1868, p. 54 — gives Table showing Entries in record-books, Distribution of duplicates, and Additions to the collection.

REPORT

OF

PROFESSOR HENRY, SECRETARY OF THE SMITHSONIAN INSTITUTION,

FOR

1869.

To the Board of Regents:

GENTLEMEN: The Institution intrusted to your guardianship by the Congress of the United States, has, during the past year, continued its operations in the line of increasing and diffusing knowledge with unabated energy. The sphere of its influence in this country and abroad has from the first been constantly on the increase, and it is now not too much to say that no institution founded by the liberality of a private individual ever attained a wider or more favorable reputation. It is true, its character is sometimes misunderstood, but this cannot be a matter of surprise when we reflect that it differs in many particulars from all other institutions, and that without an attentive perusal of the annual reports, no adequate idea can be obtained of its varied field of labor, or of what it has done and is doing to promote the special objects denoted in the will of its founder. It is here sufficient to mention that, besides adding to the sum of human knowledge by its own operations, and connecting its name with the history of almost every branch of science, it has become the general agent through which the intellectual labors of the eastern and western hemispheres are brought into efficient coöperation. The importance of its labors and the influence of the international communication which it has established, can only be properly estimated by those who are acquainted with the distinctive characteristics of modern civilization, and who realize the fact that it mainly rests on the development of a knowledge of the laws of nature and the application of these laws to the uses of life. Science not only gives man control over the physical elements, and thus tends to emancipate him from the curse of brute labor, but also serves to widen the domain of his intellectual activities and enlarge the sphere of his moral sympathies. By an attentive perusal of the following report, I think it will be admitted by all who are competent to form a proper opinion on the subject, that what I have claimed for the Institution is not too much, and that any departure from the general policy which has been constantly pursued from the beginning, would be attended with unfortunate consequences.

FINANCES.—At the last session of the Board it was resolved that a memorial be presented to Congress, setting forth the large expendi-

ture to which the Institution had been subjected by reason of the accommodation and maintenance of the National Museum, and asking that the usual appropriation of $4,000 that had been made on this account be increased to $10,000; also, that $25,000 be appropriated toward fitting up the large room in the second story of the main building, for the better exhibition of the government collections. In accordance with this resolution a petition was prepared, signed by the Chancellor and Secretary of the Institution, and presented to the House of Representatives by General Garfield, one of the Regents. It was referred to the Committee on Appropriations, and although forcibly advocated by the members of the Board belonging to the House, it was not granted, and only the usual sum was appropriated. The same memorial has, through the Secretary of the Interior, again been presented to Congress. The reasonableness of this petition must be manifest when it is considered that $4,000 is the sum which the maintenance of the museum cost the government when it was in charge of the Patent Office, and that since its removal to the Institution it has increased to three times its original size, while the money has depreciated to one-half its former value. From an accurate analysis of the accounts it appears that the items directly chargeable to the museum during the past year amount to $15,000. This sum is exclusive of the interest on $144,000, which has been expended since the fire in the restoration of the building, principally for the accommodations for the museum. Owing to the fall in the premium on gold, and the non-payment of interest by the State of Virginia on bonds held by the Institution, the income during the past year has been less than the estimate by upward of $2,400. It has, therefore, been necessary to diminish expenditures in certain directions, in order to carry out the plan of accumulating a sufficient surplus in the treasury at the beginning of the year to defray, in cash, as far as possible, all the current expenses. From the report of the Executive Committee it will be seen that this plan has been rigorously carried out; that the balance on hand at the beginning of 1870 was nearly $21,000, with outstanding bills of $3,000, which is about the amount of indebtedness at the commencement of last year. The finances of the Institution may, therefore, be exhibited as follows:

The whole bequest of Smithson in the United States Treasury	$541,379 63
Additions from savings, &c., also in the United States Treasury	108,620 37
Virginia State stock, ($72,760,) valued at	42,200 80
Cash on hand	20,969 65
Total	713,170 45
Deduct bills due, (about)	2,969 65
Which leaves, as the present capital	710,200 80

The income from the Smithson fund during the year 1869, including the premium on gold, was $49,515.

In a late report from the Treasury Department, giving a list of the appropriations of Congress for the District of Columbia, a large amount is put down to the Smithsonian Institution. This statement, without explanation, would give an erroneous impression. From the organization of the Institution to the present time it cannot properly be said that the government has appropriated a single dollar from the public treasury for the Institution. The principal "appropriations" mentioned in the report in question were not from the public money, but from the Smithson fund deposited in the Treasury of the United States. The only appropriation from the national treasury which might appear to be for the benefit of the Institution, is that of $4,000, annually made for the care and exhibition of the Government Museum, and, also, at one time $10,000, and at another $4,000, to erect cases for the better preservation of the specimens; and even in these instances, as has been shown, the Institution was far from being reimbursed for the actual expenditure on the care of the museum.

Coöperation with Government Departments.—It has always been a prominent feature in the policy of the Institution to act in unison with other institutions, and especially to coöperate with the several departments and bureaus of the general government in all cases in which their respective functions would admit of such coöperation. It is in accordance with this policy that the extensive and rapidly increasing library of the Institution has been incorporated with that of Congress, and that a similar arrangement, mentioned in the last report, for transferring to the Department of Agriculture the large Smithsonian herbarium, has been completed. It is also in accordance with this policy that an arrangement has been made with Surgeon General Barnes by which all the crania and other of the osteological specimens of the Institution have been transferred to the Army Medical Museum.

These coöperations, while they relieve the Institution from the expenditure of more than $10,000 annually, and thus enable it to more vigorously prosecute its researches, to publish a larger number of contributions, and to extend its system of international exchanges, tend also to increase the amount of scientific material in the capital of the United States, as well as to facilitate its employment in the advance and diffusion of knowledge.

This Institution and its collaborators have the use not only of its books deposited in the Capitol, but also that of those in the National Library, as may be seen by the terms of the deposit given in a previous report. Also, agreeably to the terms upon which the plants were transferred, they are accessible to the public for practical or educational purposes, and to the Institution for scientific investigation. Furthermore, a botanist approved by the Institution has been appointed, who

is to have charge of the specimens and be ready at all times to give botanical information that may be required by the general public or by the Smithsonian correspondents. Moreover, in return for the specimens transferred to the Medical Museum the Institution receives from the officers of the army all collections made in ethnology and in special branches of natural history.

PUBLICATIONS.—The publications of the Institution form an essential part of its operations and constitute the principal basis of the great system of Smithsonian international exchanges. As has been frequently stated in previous reports, they are of three classes: the Contributions to Knowledge, the Miscellaneous Collections, and the Annual Reports. The first consist of memoirs containing positive additions to science resting on original research, and which are, principally, the result of investigations to which the Institution has in some way rendered assistance. The Miscellaneous Collections are chiefly composed of works intended to facilitate the study of ethnology, natural history, and meteorology. They are designed to facilitate the progress of those who engage in special studies, to which, in their leisure moments, their thoughts may recur, and in connection with which, while contributing to their own pleasure, they may advance the cause of science. The Annual Reports, besides giving an account of the operations of the Institution, furnish, in an appendix, matter of importance to the meteorological observer and of interest to the general public. The Contributions and Miscellaneous Collections are published at the expense of the Smithson fund, while the Reports, with the exception of the illustrations, are printed by the government.

The following is a list of the quarto publications that have been printed during the present year:

1. On the Gray Substance of the Medulla Oblongata and Trapezium. By John Dean, M. D.

2. On the Orbit and Phenomena of a Meteoric Fire-ball, seen July 20, 1860. By Professor J. H. Coffin, LL.D.

3. On the Transatlantic Longitude. By Benjamin A. Gould.

4. The Indians of Cape Flattery, at the Entrance of the Strait of Fuca, Washington Territory. By J. G. Swan.

5. Systems of Consanguinity and Affinity of the Human Family. By Lewis H. Morgan.

6. On the Gliddon Mummy Case in the Museum of the Smithsonian Institution. By Chas. Pickering.

7. A new edition of Brewer's North American Oölogy.

Of these Nos. 1 to 6, together with Hildreth's and Cleveland's Meteorological Observations, previously described, form the 16th volume of Smithsonian Contributions to Knowledge, which will be distributed to the foreign correspondents of the Institution in the next invoice, and, as soon as an additional number can be bound, to the public institutions of this country.

The following are the titles of the articles of the octavo series that have been printed during the year, or are now in press:

1. Land and Fresh Water Shells of North America. Part I. By W. G. Binney and T. Bland.

2. Photographic Portraits of North American Indians in the Gallery of the Smithsonian Institution.

3. List of Foreign Correspondents of the Smithsonian Institution. New and enlarged edition.

4. Directions for Collecting, Preserving and Transporting Specimens of Natural History. Prepared for the use of the Smithsonian Institution. (New edition.)

5. Tables, Meteorological and Physical, prepared for the Smithsonian Institution. By A. Guyot, P. D., LL. D. (New edition.)

6. Circular in Reference to the Degrees of Relationship among Different Nations. (New edition.)

At the request of the Institution the preparation of the Manual of the Land and Fresh Water Shells of North America was undertaken by W. G. Binney. The second and third parts of this work were published some years ago, and have been described in previous reports. The first part, which completes the work, was issued during the year 1869, and forms by itself a volume of 328 pages, illustrated with many woodcuts. The work was at first undertaken by Mr. Binney alone, but he afterward, in this part, associated with himself Mr. Thomas Bland, of New York. It contains a description of all the species of land shells known in January 1868, within the geographical limits of North America, from the extreme North to the Rio Grande and Mazatlan. It is considered a valuable contribution to the study of conchology and is in great demand among those interested in the pursuit of this branch of natural history.

From the stereotype plates of these octavo works, from which impressions have been printed and separately distributed in pamphlet form, two additional volumes of the Miscellaneous Collections have been made up, and are nearly ready for distribution.

On account of the great outlay for the building during the last few years, the appropriations for publications have been restricted; yet from the foregoing it will be seen that we shall be able to distribute in our next foreign invoice one quarto and two octavo volumes, which, with the Annual Report, will make four volumes of publications issued during 1869.

A brief account has been given in previous reports of the contents of all the papers forming the 16th volume of Contributions, excepting the Gliddon Mummy Case, the Indians of Cape Flattery, and the Transatlantic Longitude.

The first of these is by Dr. Charles Pickering, of Boston, one of the ethnologists of the United States Exploring Expedition, under Admiral Wilkes. It relates to an interesting specimen of Egyptian archæology

presented, in 1842, by Mr. Gliddon, the Egyptologist, to the national collection now in charge of the Smithsonian Institution, but at that time in the United States Patent Office. It consists of a part of the lid of a mummy case procured at Sacara from an Arab. It does not bear any inscription by which its date can be determined, but it is supposed by Dr. Pickering to belong to a very early period, and to be among the oldest—if not the very oldest—of specimens of hieroglyphic writing known. The earliest writing, of ascertained date, was executed in the third dynasty from 3110 to 3080, B. C.; but, according to Dr. Pickering, the writings on the mummy case in the Institution are of a style different from, and clearly anterior to, that executed in the third dynasty. Toward the beginning of this era, on the authority of Manetho, writing was improved, and as all improvements of this kind have tended in the direction of an increased facility, this mummy case at least seems to have preceded such a change. The lid was divided by Mr. Gliddon into three parts ; the first part is the one just described, the second was presented to the Naval Lyceum of Brooklyn, the third to Mrs. Ward, of New York. Diligent though unsuccessful inquiry has been made for the missing parts, in order to have them also figured and described; and now, through this report, attention is again called to the subject, with the hope that if the other portions of the lid are still in existence, information of the fact may be communicated to the Institution. The part of the lid above described is represented on a large plate which presents a fac-simile of the figures as to size and color.

The second undescribed paper is that on the Indians of Cape Flattery, which, there is no doubt, will be considered an interesting contribution to ethnology. It was prepared, at the request of the Institution, by Mr. James G. Swan, an agent of the United States government, who had long resided with the tribe of which he has given an account. This tribe occupies the extreme northwestern part of Washington Territory, opposite Vancouver's Island, from which it is separated by the Strait of Fuca. The paper contains a full account of the manners and customs of these Indians, and a description of their implements, utensils, clothing, modes of travel, fashion of constructing houses, &c. It also gives a minute account of the festivals and ceremonies of these Indians, and of the various myths with which these are connected. Among other singular superstitions is that of the resurrection, as it were, of the flesh of the body but not of the bones, which are left in the graves; that the spirit world is in the center of the earth, where the inhabitants are somewhat incommoded by the want of the osseous part of their bodies. The memoir is illustrated by a large number of woodcuts, most of them copied from specimens now in the museum of the Institution. In the absence of the author of the work it was edited by George Gibbs, esq., who has added occasional notes, and also a vocabulary of the Makah tribe, furnished by Mr. Swan.

The third memoir to be described is the report of Dr. B. A. Gould on

the Transatlantic Longitude. The principal results of this investigation were communicated by Dr. Gould to the meeting of the National Academy of Sciences, during its session in 1867, and the report in full was presented to the Institution for publication, with the consent of the Superintendent of the Coast Survey, Professor Peirce, in February 1869. It relates to the determination of the difference of longitude between England and America, by means of the electro-magnetic telegraph. This method was first practically applied in the Coast Survey of the United States, between places in this country, and received its full development in this great national work before it began to be used elsewhere. Previous to the introduction of this method, three others had been employed on the Survey. First, that of observations of the time of the culmination of the moon at the two places between which the difference of longitude, or, in other words, of time, was to be determined; second, that of observing the times of beginning and ending of eclipses of the sun and of occultations of known stars by the passage over them of the moon; and third, that of transporting a large number of chronometers between England and America a number of times in succession and obtaining the average difference of time as indicated by the whole series. The determinations of the transatlantic longitude which have been obtained by these methods have been generally referred to the Capitol at Washington and the Observatory at Greenwich, England, as standard points. From the several methods just mentioned, and also from that of the electro-magnetic telegraph, the following results have been obtained:

From eclipses and occultations the difference in time between the dome of the Capitol and the Greenwich Observatory is	5^h	8^m	$14^s.86$
From moon culminations the difference is	5^h	8^m	$10^s.12$
From the transportation of chronometers the difference is	5^h	8^m	$12^s.30$
From the transmission of electricity through the cable, and the use of the electro-magnetic telegraph, the difference was found to be	5^h	8^m	$12^s.45$

By the last method the difference of time between the ends of the cable was probably determined within the fraction of a second, but as the signals could not be sent directly between Greenwich and Washington, a somewhat greater departure from the actual difference must be allowed. This difference is, however, very small, not exceeding, perhaps, a single second.

The process of ascertaining the difference of time, or in other words, the difference of longitude of two points, by means of the telegraph, consists in transmitting a series of signals either way through the conductor, and in observing the exact time of the appearance of the signal at one station, while its time of starting is registered at the other. If

the transmission of the signal were instantaneous, the difference of time observed would be the exact difference of longitude; but if any time elapses between the making of the signal at one station and its appearance at the other, the difference of time will be greater than the true time when the signal is sent eastward, and less than it when sent westward. If the velocity of transmission be the same in both directions, the true difference of longitude will be obtained by taking the mean of two sets of differences, the one giving the longitude as much too great as the other gives it too small.

From experiments on the velocity of transmission of electrical impulses through long conductors, it is probable that the first part, as it were, of the electrical wave reaches the distant station in an inappreciable moment of time, but that in order to overcome the inertia, and give perceptible motion to the signal apparatus, an accumulation of power is required. The time necessary to this accumulation will depend on the weight, and other causes of resistance in the apparatus, and also on the intensity of the electrical current; hence, the two instruments ought to have precisely the same degree of sensitiveness, and the battery during the continuance of the experiment should retain the same electro-motive power.

The method of telegraphing, employed with the cable, is that devised by Sir William Thomson, of Glasgow, and is founded on the application of the principle of reflection first applied to instruments of precision by our countryman, Joseph Saxton, of the Coast Survey. It consists of a mirror of about half an inch in diameter, to the back of which is attached a small magnetic needle, the joint weight of the two being less than one grain, which is suspended, by a single fiber from the cocoon, in the center of a coil of many spires of fine wire, forming part of the galvanic circuit. Upon this mirror is thrown a beam of light through a slit in front of a bright kerosene lamp, and the deflections of the needle are noted by the movements of the reflected beam received upon a slip of white paper. The exquisite delicacy of this galvanometer, as well as the conducting power of the telegraphic cable, may be appreciated from the result of an experiment in which signals were sent from Ireland to Newfoundland, a distance of 2,160 miles, by means of a battery composed of an ordinary percussion gun cap, in which was inserted a morsel of zinc and a drop of acidulated water.

For determining the time in these observations, a small transit instrument, a chronograph, and an astronomical clock were required at each station, for the accommodation of which a temporary observatory was erected. The observations on the American side were in charge of Mr. G. W. Dean, with the assistance of Mr. E. Goodfellow, while those on the coast of Ireland, as well as the general direction of the enterprise, were under the charge of Dr. Gould, assisted by Mr. A. T. Mosman. The use of the cable was freely granted by the Anglo-American Company, and Dr. Gould received from the astronomer royal, Dr. Airy, and

the electricians of the company, all the facilities and assistance necessary to the undertaking. The report contains a series of investigations relative to the time of transmission of signals, and other points, which can only be properly understood by a study of the work itself.

The Annual Report for the year 1868 was printed, as usual, by order of Congress, and the extra number of ten thousand copies ordered. I would again urge upon Congress the propriety of increasing the number of copies, since the demand has become so great that it is impossible, with the number above mentioned, to meet the applications for them of the correspondents of the Institution or of the constituents of the members of Congress themselves.

In addition to the report of the Secretary giving an account of the operations, expenditures, and condition of the Institution for the year, and the proceedings of the Board of Regents, it contains the following articles: List of Smithsonian meteorological stations and observers in North America and adjacent islands, from 1849 up to the end of 1868; Memoirs of Cuvier, and history of his works, of Oersted, Schönbein, Encke, and Hodgkinson; Articles on recent progress in relation to the theory of heat; Principles of the mechanical theory of heat; Continuous vibratory movement of all matter; Radiation; Synthetic experiments relative to meteorites; Catalogue of meteorites in Yale College; The electric resonance of mountains; Experiments on aneroid barometers; Anniversary address of the president of the Royal Society of Victoria; Report of the transactions of the Society of Physics and Natural History of Geneva, and of the Anthropological Society of Paris; An original communication on drilling in stone without metal, and on a deposit of agricultural flint implements in Southern Illinois, by Charles Rau; Notice of the Blackmore Museum, England; Programmes of several foreign societies; An account of the assay of coins at the United States Mint; Table of foreign coins; and a complete list of the publications of the Smithsonian Institution.

INTERNATIONAL EXCHANGES.—The two objects of the bequest of Smithson, as briefly, though clearly, expressed in his will by the terms "increase" and "diffusion" of knowledge, are both fully provided for in the plan of organization. The *increase* of knowledge is principally effected by the researches that are instituted at the expense of the Smithson fund in the various branches of science, and the *diffusion* of knowledge by the publication of the results of these researches and their distribution to all the principal libraries of the world, and still more generally by the great system of international exchange which has been established. The effect of this system, in its present enlarged dimensions, in the way of facilitating direct correspondence between the scientific men of the Old and New World, can scarcely be overestimated.

During the year that has just closed, 1,734 packages, containing many thousand different articles, have been transmitted to 1,569 parties in

foreign countries. These packages were contained in 112 boxes, having a cubical content in the aggregate of 1,033 feet, and weighing 23,376 pounds. The packages were not only from institutions within the limits of the United States, but also from those in Canada, Central and South America. The parcels received at the Institution for parties in this country numbered 2,600, about one-third more than were received during the preceding year. The separate volumes, parts of volumes, and pamphlets contained in these parcels would amount to many times the number just given, those for the Institution alone amounting, as will be subsequently stated, to 5,555. When it is considered that these works are the published original records of the discoveries of the day in the various branches of science; that they mark the progress of man in a higher civilization, and that the system of exchange tends to unite in one effort, as it were, the labors of those who are endeavoring to enlarge the bounds of knowledge, it is impossible to conceive of a system more efficient or better calculated for realizing one of the conceptions of Smithson, that of diffusing knowledge among men.

The exchanges thus far have principally been confined to books, although large numbers of specimens have been sent abroad on the part of the Institution. Full returns have not yet been asked for these, but one of the conditions on which the specimens are given is that whenever the government shall see fit to make provision for the full support of a national museum, then specimens will be required in return. It is proper to state, however, that in all cases in which the Institution has signified its desire to obtain specimens for special investigations, or for the illustration of a particular subject, such as geology and anthropology, liberal responses have been made.

The Smithson packages, with the single exception of those for Italy, are passed through all the custom-houses of the world free of duty and without examination; and this exception will, we think, be removed as soon as the negotiations now in progress are completed. Efficient aid during 1869, as in previous years, has been rendered the Institution in the transportation of its packages to and from the United States, free of charge, by the following companies, viz: The Pacific Mail Steamship Company, North German Lloyd, Hamburg American Steamship Company, General Transatlantic Steamship Company, Pacific Steam Navigation Company, Inman Steamship Company, Cunard Steamship Company, California and Mexico Steamship Company, Panama Railroad Company, Mexican Steamship Company, Union Pacific Railroad, United States and Brazil Steamship Company, North German Lloyd, (Baltimore line,) and the Atlantic Mail Steamship Company. It gives me much pleasure to make this public statement in regard to an act which deserves commendation, not only on account of the liberal spirit which it manifests, but also on that of the enlightened appreciation which it evinces of the objects of the Institution. Notwithstanding the aid which has been thus liberally extended, the cost of the exchanges now amounts to about $5,000 per annum.

The following are the centers to which the Smithson invoices are consigned: Leipsic, care of Dr. Felix Flügel; London, care of William Wesley; Paris, care of Gustave Bossange; Amsterdam, care of Frederic Müller; Milan, care of L. dell' Acqua; Christiana, care of Professor Holst, of the University. The packages for Asia, Africa, and Oceanica are principally sent through London or the American Missionary Societies. The invoices to South America are forwarded, through the gratuitous services of Mr. Hillier, of the New York custom-house, by regular trading vessels from that city.

In 1867 a proposition was made to the Institution by the Librarian of Congress relative to establishing and conducting a system of exchange of official documents between the government of the United States and that of other nations. In accordance with this, a circular was addressed to the different governments having relations with the United States for the purpose of ascertaining their views as to such an exchange. In every case the proposition was regarded with favor, and at the ensuing session of Congress an act was passed directing that fifty full sets of all documents published at the Government Printing Office should be set apart for the purpose in question, and appropriating a sufficient sum to defray the necessary expenses. Unfortunately, however, Congress neglected to direct the Public Printer to strike off the copies requisite for this purpose, in addition to the regular number previously required for the use of the government, and it was not until recently that the necessary legislation was procured to remedy this omission. As soon as the printing and binding of the documents of the last session of Congress are completed the proposed exchange will be initiated. In anticipation of the receipt of the annual supply of the documents of our government, several large packages containing documents of foreign countries have been already received.

On account of the large additions that have been made of late years to the number of societies and other parties in correspondence with the Institution, a new and revised edition of the list of the former became necessary, and this was prepared during the last year. In order to insure accuracy in the titles and localities of the various establishments, proof-slips of the list were sent to the leading foreign societies through our agents, and also to the diplomatic representatives in this country. In all cases prompt attention was given to our request, and many important corrections and suggestions were received. This list, which now numbers 1,587 literary and scientific establishments, is not only essential to the Institution in addressing its foreign packages, but also, for a similar purpose, to the libraries and societies in different parts of the United States, Canada, and South America.

LIBRARY.—The works, which have been received from all parts of the world in exchange for the publications of the Institution, after being recorded are transferred to the National Library, agreeably to the

arangements described in former reports. The following is a general statement of the number of books, maps, and charts received through exchange during 1869:

Volumes:		
Octavo	946	
Quarto	245	
Folio	43	
	——	1,234
Parts of volumes and pamphlets:		
Octavo	3,238	
Quarto	709	
Folio	142	
	——	4,089
Maps and charts		232
Total		5,555

Of the larger donations received during the year in question are the following:

From Iceland Foundation Library, Reikiavik, 44 volumes and 12 pamphlets.

Swedish Academy of Sciences, Stockholm, 56 volumes and 5 pamphlets.

From the Emperor of Austria, 8 volumes and 9 charts.

Public Library, Stuttgart, 118 volumes.

University, Greifswalde, 114 pamphlets, Inaugural Dissertations.

From the Institut de France, 31 volumes.

Ministère de la Marine et des Colonies, Paris, 6 volumes and 40 pamphlets.

Commission Impériale de l'Exposition Universelle de 1867, Rapports du Jury International, volumes I–XIII.

Société de Statistique, Paris, 13 volumes and 28 pamphlets.

Académie de Montpellier, Faculté de Médecine, 22 volumes, Thèses.

From the Society of Engineers, London, 8 volumes, Transactions.

British Museum, 9 volumes and 8 pamphlets.

Royal Archæological Institute of Great Britain and Ireland, 20 volumes, Journal.

From the Bombay Government, 15 volumes, Selections from the Records of the Bombay Government.

National University, Athens, Greece, 37 volumes and 132 pamphlets.

Legislative Assembly of Canada, 17 volumes.

State of Minnesota, 6 volumes, Plate, Documents.

C. M. Hovey, editor Boston Magazine of Horticulture, Botany, &c., 35 volumes.

The Smithson books have been well cared for by Mr. Spofford, the efficient Librarian of Congress. Several thousand have been bound,

and a large number are now in the hands of the binder, each volume being marked on the back with a stamp indicating that it is a Smithson deposit.

In the arrangement of the National Library the publications of learned societies, of which the Smithson books principally consist, form one chapter of the general collection, which occupies the greater portion of the south wing of the western projection of the Capitol. It is desired by the Institution, as well as by the National Library, that this collection should be as complete as possible in the publications of all learned societies which have existed from their first establishment in Italy, about the middle of the sixteenth century, until the present time. Through the kindness of the older societies of Europe a larger collection of their publications has been made by this Institution than was ever before formed in this country, or, with few exceptions, in any of the cities of the Old World. Still, there are many series wanting, and several of those now in our possession are defective; exertions will therefore be made, through our correspondents, to supply deficiencies. The value of the scientific collections as well as of the general library will be much enhanced by the catalogue of books, and particularly that of subjects now in progress, and which, as we are informed, will be completed during the present year. The third volume of the index of scientific papers, prepared by the Royal Society of London, has been printed and will soon be distributed. The completion of this great work will have an important influence on the use of the National Library, to which it will be especially applicable.

The national library has increased so rapidly during the past three years, that the three-fold space allotted to it in the Capitol is now insufficient for its accommodation. Further room, as we learn, has been asked for, and we would suggest that this might be best secured by the erection of a separate building, in whose plan of construction should be incorporated all the latest improvements for the use and protection of books. But whatever may be done in this way, greater facilities than now exist for the consultation of the library should be afforded, by making it accessible in the evenings to those who are precluded from the use of its collections by their official occupation during the hours at which it is now open.

GALLERY OF ART.—It was stated in the last report that Mr. W. W. Corcoran, with an enlightened liberality only commensurate with his means, had resolved to found in Washington an institution exclusively devoted to art. This design, which would long since have been carried into execution, was interrupted by the war, the building erected for the purpose having been applied to the uses of the government; but we are gratified in being able to state that the possession of it has been restored to Mr. Corcoran, and that he has placed it in charge of trustees, who are to fill vacancies in their board and direct all the affairs of the establishment.

The gallery will probably be open for exhibition to the public and to students in art during the present year. The establishment of this collection, as we have said in a previous report, will obviate the necessity of expending any of the funds of the Institution in supporting a national gallery, and I would suggest that the same policy which has directed the transfer of the library, the herbarium, and osteological specimens to the National Library, the Agricultural Department, and the Medical Museum, be also extended to the Corcoran Gallery. The Institution has a number of pictures and a large collection of plaster busts, which are scarcely in place in the midst of specimens of natural history, but which would produce a better effect in connection with other works of art of a similar character. There need be no danger as to impoverishing the Institution by this liberal policy, since it is in reality but another method of increasing its usefulness.

The saving which is made by transferring the keeping of the library and botanical collections can scarcely be estimated at less than $12,000 per annum, a sum which adds to the efficiency of the Institution in the way of increasing, by the exchange of its products, the collections of objects of nature and art in the national capital, besides adding to the intellectual wealth of the whole country.

MUSEUM.—During the past year the space occupied by the museum has been enlarged by appropriating to it the portion of the building known as the western connecting range, which consists of a room 61 feet long by 38 feet wide. On either side of this room has been erected a row of (seven) upright cases, and in the middle a series of tables extending the whole length of the apartment. The upright cases on the south side have been entirely filled with ethnological specimens from China and Japan, comprising the presents from the governments of these countries to the President of the United States. In the cases on the north side is arranged a large and valuable collection of the dresses of the Indians of the northwest coast and of the Esquimaux of North America. The table cases are also filled with ethnological specimens, among which are many exhibiting the rarer specimens of Indian workmanship, and also those of prehistoric times, from the explored caverns of France, presented by Professor Lartet.

During the year 1869, 390 packages, containing many new specimens and thousands of duplicates, have been received at the Institution, and of these, as far as time would permit, a single choice series has been selected for the museum; the remainder are placed aside to be classified and made up into labeled sets for distribution. In pursuing this policy, to which the Institution is bound by its office of curator of the government collections, it is impossible to restrict the increase of the museum, and now, notwithstanding the great number of specimens that have been given away, nearly the whole of the available space in the building is filled to overflowing. An appropriation for finishing the large hall in

the second story is, therefore, very desirable, but as this room is wanted for the accommodation of the National Museum, and not for the uses of the Institution, it would be highly improper to finish it by a further encroachment upon the capital of the Smithson fund.

We have mentioned in a previous report that the architecture of the large room, in which the specimens are at present exhibited, is not well adapted to an advantageous display of many of the articles, since a considerable portion of the space is occupied by two rows of colossal columns, between which and the walls the cases, forming alcoves, are placed. The ceiling, however, of the hall in the second story is to be attached to the long, iron girders which span the space from wall to wall, and it will not, therefore, require the introduction of columns. It is hoped that in the finishing of this room the primary object of its use will be kept in view, namely, the exhibition of specimens. There is pleasure in perfect adaptation as well as in æsthetical effect; the two, however, are not incompatible, and a proper conception of the true spirit of architecture will never sacrifice the former to obtain the latter.

Since the date of the last report the museum has been increased by specimens in every branch of natural history and ethnology, especially in those of ornithology and the products of the explorations of mounds. An unusual amount of labor has also been expended on the specimens during the same period. The large number of birds in the drawers, as well as those on exhibition, have been re-poisoned to prevent the attack of insects, while those in the cases have been furnished with new stands, and their plumage brightened by washing them with benzine. The cases themselves have been repaired and painted. The mounting of the archæological collections on boards, and the repairing of the articles of pottery, have been continued, and are now nearly completed. The specimens of quadrupeds belonging to the older collections of the government present rather an unsightly appearance, through injury by insects before they were brought from the Patent Office, and because they were not well prepared. Many of them, however, are very rare, and should be kept until better specimens can be obtained.

No small amount of labor is required, in a large museum, to keep up a descriptive catalogue of the various articles it receives, and to this work alone the entire time of a clerk might properly be devoted. The whole number of entries in the catalogue of the National Museum is now 158,662; and of these 16,265 were made during the last year, while of the specimens of the general collection of which no types have been selected for exhibition many thousands of entries yet remain to be inserted.

By the co-operation previously alluded to in this report, the Army Medical Museum, the Museum of the Agricultural Department, and the National Museum are rendered supplementary to each other, each collecting and preserving articles that are not contained in the others. The Commissioner of Agriculture, General Capron, has shown much

zeal and good faith in carrying out the conditions previously mentioned, on which the transfer of the plants was made, by fitting up a spacious room with cases which contain 600 separate compartments for the reception of as many different families of plants, and by appointing a botanist fully approved by the Institution. Dr. Parry, the botanist in question, was a pupil of Dr. Torrey, and for the last twenty years has been engaged in various government explorations, mostly in the western part of the United States. He was warmly recommended by the first botanists of the country, and, I doubt not, will discharge the duties of his office to the satisfaction of all interested in the advancement of this branch of natural history. He has begun to arrange the plants in systematic order for immediate reference, and finds the number of species to be about 15,000, included in 25,000 specimens. The additions that have been made to the collection during the past year, embracing those which have been supplied by the Institution and the Department itself, according to Dr. Parry number 8,000 specimens, including 3,000 species. Besides the specimens of dried plants transferred to the Agricultural Department, a large and interesting collection of woods, from Mexico and South America, has been added to the deposit.

LECTURES.—Previous to the fire which destroyed the upper portion of the main building, in 1865, courses of free lectures were given by the Institution to the visitors and citizens of Washington. These at first, or as long as the novelty continued, were well attended, but in time, owing, in part, to the difficulty of access, in the winter season, to the building, and the absorption of the public mind by the events of the war, the interest diminished, while the management of the system became much more difficult, inasmuch as it was impossible to prevent the introduction of political subjects. The call, however, on the part of the citizens for lectures has lately been renewed. But it must be evident, on a little reflection and from past experience, that the original plan cannot again be adopted without great inconvenience and an expense not commensurate with the value of the results produced. In order, however, to assist in the establishing in this city, during the present winter, of a course of lectures on scientific subjects, and at a low price of admission, it has been thought advisable to grant a moderate appropriation to the Young Men's Christian Association, to enable it to secure the services of distinguished popular lecturers. The building which has been erected by this society not only serves as an ornament to the city, but supplies a want long felt in affording a spacious hall for lectures, conventions, &c. The lectures to which the Institution contributed were of a scientific character, requiring expensive illustration, and, therefore, though they were well attended, they could not have been given at the low price charged for admission, had not aid been afforded.

EXPLORATIONS AND COLLECTIONS IN NATURAL HISTORY.—In this report, as in other of the Smithsonian reports, a distinction is made between the collections of the Institution and those of the National Museum under its charge. The former consists of the large number of specimens (in some instances including hundreds of duplicates of rare as well as of more common species) which have been collected under the auspices of the Institution or through its special agency. These are studied and classified by experts for the formation of monographs and the determination of species and their geographical distribution; or, as is the case in ethnological specimens, are compared for the purpose of tracing anthropological peculiarities; and, finally, made up into properly labeled sets for distribution to museums in this country and abroad. The organization of explorations and the collection of specimens would be important parts of the operations of the Institution were it entirely disconnected from the National Museum. Natural history and ethnology are interesting branches of knowledge, and justly merit a portion of the Smithson patronage; but the National Museum has no just claim on the Institution other than for a perfect series of all the duplicates collected; and it is too much to ask, in addition to this, that the Smithson fund should continue to provide it with house-room, and, in a large degree, with attendance. The distinction we have made is an obvious one, though it may be difficult, in some instances, to draw a line between the specimens in the museum and those of the Smithsonian collections.

Explorations and collections in Natural History have been continued, as in previous years, by the Institution alone, or in connection with other establishments. In giving an account of what has been done under this head, the geographical order adopted in other of the Smithsonian reports will be followed.

Northwest Coast of America.—Mr. McFarlane and Mr. McDougal still continue to collect specimens of the natural products of the Mackenzie River district. Mr. Ferdinand Bischoff has kept up his researches in Alaska, first at Kodiak, then at Kenai. Major General George H. Thomas, of the United States Army, has rendered especial service in collecting in the same region specimens of coal and of zoölogy. The remainder of the natural history collections of Mr. Dall, referred to in the last report, has been received and found of much interest as an illustration of the natural productions of our new possessions in the Northwest. His collections in ethnology will be mentioned further on. Captain C. M. Scammon has continued his explorations, and has presented interesting collections from Alaska and Puget Sound, in addition to several communications relative to the natural history and habits of the seals of the adjacent coast. Dr. Minor has also continued his valuable contributions from the same region.

Western United States.—The geological survey of the fortieth parallel, under Mr. Clarence King, referred to in the last report, has been continued during this year, and the collections made in zoölogy, botany,

mineralogy, and geology, have been deposited in the Institution. They are now in process of examination, and an account of them will be given in the valuable report of Mr. King, which Congress has ordered to be printed. At the last session of Congress an appropriation of $10,000 was made for the continuance of the geological surveys of Dr. F. V. Hayden. He was instructed by the Department of the Interior, under whose direction the money was to be expended, to examine especially the geology, mineralogy, and agricultural resources of the Territories of Colorado and New Mexico. The exploration began at Cheyenne, Wyoming Territory, and was continued through Denver, the silver and gold mining regions of Georgetown and Central City, the Middle Park, Colorado City, and Fort Union to Santa Fé, returning to Denver by way of the San Luis Valley and South Park. In the language of the Secretary of the Interior, "this exploration, though brief and rapid, was eminently successful, and the collections in geology, mineralogy, botany, and zoölogy were extensive." These collections have been deposited in the Institution, from which they will be sent for examination to persons who have made special study of the branches of natural history and zoölogy to which the specimens pertain.

Mexico and Central America.—The explorations of Colonel Grayson, in Northwestern Mexico, spoken of in previous reports, were continued in the early part of the year, and an additional series of specimens transmitted to the Institution. It is, however, with deep regret we have to announce that the labors of this enthusiastic and enterprising naturalist were suddenly terminated by death, from fever contracted in an attempt to explore the Island of Isabella. By his decease the Institution has lost a highly-valued correspondent, and the cause of science a successful cultivator. He devoted many years of his life to the development of the natural history and physical geography of Northwestern Mexico and the adjacent islands; and it is much to be regretted that he had not lived to complete the work in which he was so much interested. The explorations of Professor Sumichrast, on the Isthmus of Tehuantepec, have been nearly completed, and the large number of well-preserved specimens in all branches of zoölogy, received at the Institution from this region, attest his continued enthusiasm and persevering industry. From our veteran correspondent, Dr. C. Sartorius, of Mirador, important collections have been received during the past year.

South America.—Mr. Hudson, of Buenos Ayres, and Mr. Reeve, of Ecuador, have furnished a continuation of the results of their ornithological explorations in these localities, while an interesting series of the birds of Demerara has been contributed by Colonel Figyelmesy.

Most of the collaborators just mentioned have furnished information in regard to the physical geography and the inhabitants of the country from which the specimens were derived, and in this way the Institution has accumulated a large amount of manuscript material relative to the natural history, geology, and ethnology of the different parts of North America, not generally known.

EXPLORATIONS AND COLLECTIONS IN ETHNOLOGY.—During the past year the effort has been continued to increase the collections of ethnology and archæology of the North American continent. It has been considered of special importance to prosecute this subject, since the remains of the ancient people who have inhabited this continent are every year becoming more rare. The mounds are disappearing in the process of agriculture, in the construction of railways, or in the extension of cities, and their interesting contents destroyed or scattered beyond the hope of future recovery. A very extensive correspondence on this subject has been kept up during the year with persons in every part of North America, soliciting information and specimens, giving directions for examining mounds and shell-heaps, and in several cases making a small appropriation for defraying the expenses of special investigations.

Nearly all the explorers mentioned in previous reports have contributed valuable material in this line. During his visit to the Bay of Fundy, Professor Baird, of this Institution, made extensive explorations among the ancient shell-heaps and gathered some facts and specimens of much importance in connection with the subject of the American Kjoekkenmoedding. In these labors he was assisted by Mr. G. A. Boardman, Professor H. G. Webster, Professor Nelson, Mr. Elias Kinny, Mr. Gardner, Mr. Hallett, and also by Captain Treadway, of the United States revenue service.

As ethnology is a branch of study which, at this time, is occupying popular attention, it may be proper to give a more detailed account than usual of the additions that have been made in this line during the year which has just closed. This account is compiled from the descriptive inventory made by Dr. Foreman, under the direction of Professor Baird, in a record book of the collections. For convenience of reference the geographical division is adopted.

British America, Arctic Region.—Mr. Robert McFarlane, stationed at Fort Anderson, one of the Hudson Bay Company's posts in the McKenzie River district, with unabated perseverance, has continued making collections in natural history and ethnology, and has presented to the Institution, with a liberality which cannot be too much commended, a great number and variety of articles to illustrate the character of the people among whom he has so long resided. Intercourse with traders and others has considerably modified their arts of life, and they now present an example of a people in a state of transition from the stone to the iron age. Among the articles from Mr. McFarlane, which illustrate this change, are knives of pieces of iron hoops, spear-heads and fish-hooks of the same material; pipe-bowls of copper and of pewter, and a drilling apparatus, with an ordinary bow and drills tipped with bits of steel; boxes, of which the parts are fastened together with wooden nails, iron being too precious to be used for this purpose; other boxes, of which the parts are joined in the more ancient fashion by stretching over them, in a moist condition, a casing of leather.

The greater part, however, of the articles are of a primitive character, among which, for out-door use, are dog harness, lassos of moose-hide for large animals, and more slender ones, carrying rounded pieces of bone, nut size, to entangle the legs of geese; different models of the sledge for hauling wood and provisions; a stretcher of deer-skin; bows, with arrows, quivers, and cases; a long line of whalebone for fishing; a net of sinew, with bone fish-hooks, fishing floats, spears, throwing-sticks, spear-rests for the deck of the canoe; a whistle or call used in hunting; snow-shoes and models of canoes; screens of wood to protect the eyes from snow blink, concave on the inner side, with two very narrow slits for looking through. Of the articles relative to indoor occupation are deer-skin boots; white and black wolverine gloves; children's garments, neatly made, of soft materials; capuchons, or coverings for the head; tools, with which this and other work is performed, such as awls, drills, polishing implements, of either jasper or carnelian, frequently of bone; a small leather bag of red paint, with pitch or other cementing material. There are also needles of bone, needle cases of ivory, pouches ornamented with beads, for containing sewing fiber. Bunches of this material, arranged as if for a chignon, appear to belong to articles used by women. A rattle of deer or musk-ox hoofs, used in dancing, and bone implements for gambling, suggest the character of native amusements.

From the same district have been received, through the Rev. W. W. Kirkby, a leather pouch, filled with quills of the porcupine, which are used to ornament moccasins, belts, and fire bags; also a fur coat made by the Dog Rib Indians. There are not many articles of personal decoration, except some labrets, thick buttons of white limestone, and bits of blue glass, cemented together, to be worn in a slit of the corner of the mouth after the manner of a sleeve button.

Alaska.—The collections of Mr. W. H. Dall in the Aleutian Islands, at Norton Sound, and in the Yukon region, mentioned in the last report, have been received and are found to be very extensive and interesting. Those from the Aleutian Islands are specimens of native carving in walrus ivory, which exhibit considerable imitative skill in copying the forms of objects introduced by white traders. Among them are a table knife and two spoons, neatly executed. The greater part, however, of Mr. Dall's collection are from the various tribes of Esquimaux living on the shores of Norton Sound, more particularly the articles of clothing made of furs and leather, prepared from the skins of the deer and other animals. These consist of outer and inner garments, for both sexes, and of boots, gloves, and mittens. It would appear from the specimens that the skins of the larger fishes, and also of the seal, are used for articles of dress, adapting the material to the change required for winter and summer. From the region of the River Yukon there are snow-shoes, moccasins, fur dresses, straw-shoes and boots, for riding and dancing, all made and used by the Mahlemuts. The domestic implements of the people are exhibited in a series of spoons or dippers, made of the

broad horns of the Rocky Mountain sheep, wooden bowls, ladles, platters, cups, and trays; bags and haversacks made of seal or fish skin, of all sizes, universally used by the Esquimaux for keeping provisions and other materials; also earthenware lamps, fire bags with flint, steel, and tinder; tobacco pouches, pipes, and snuff-boxes. The articles made of seal-skin on the coast are imitated farther up the river in the skins of the larger fishes, the intercourse between the localities being difficult since the passes are held by a few trading Indians, who act as middle men in exchanging commodities and as guards to prevent access to the coast. From the Unaleets there are neatly-made housewives of fish-skin, and from the Pastolic Esquimaux a small workbag woven of grass, ivory needle cases ornamented with blue beads, and a store of thread made of filaments of dried sinews. The weapons received are interesting illustrations of the character and habits of the people. The bows in this collection, used by the Esquimaux for killing large birds or fish, are of very unusual weight, and many of the arrows employed in shooting the wild goose are tipped with a blunt knob. The sharp arrow-points are the most beautiful and delicate of any we have seen, and are of obsidian, green jasper, or glass. The seal and fish lines are of the long, flexible stems of a *fucus* which grows in deep water and equals whalebone in tenacity and toughness. The harpoons for striking seals are furnished with a horn or bone termination, carrying a barbed point, the whole being detachable from the shaft. From the Ekogmut there are several of these, with others used in killing the whale; also models of canoes, oars, &c., from the Lower Ingaleeks along the Yukon and the Unaleets on the coast. In the way of personal ornament there are a quantity of red paint and a yoke, or necklace, oval pieces of wood or stone to be inserted in a slit in the lower lip, the nose, or the ear; finger-rings, principally of stone, of two kinds, one of which is used on mourning and the other on ordinary occasions.

Aleutian Islands.—From the Aleutian Islands there are in Mr. Dall's collection several hideous masks of gigantic dimensions used in the ceremonies of the people. Dr. T. T. Minor, surgeon United States revenue steamer Wayanda, Captain Howard, commander, who visited Sitka, Kodiak, Unalaska and some points of the Aleutian group, has furnished collections exhibiting the dress, occupations, and habits of the Coloshes, Nuhegags, and Aleutes. The scarcity of stone implements in this collection is worthy of notice, since but two specimens, a pestle and axe, are all that were found, and these were regarded as very ancient. Among the articles are the following: Heavy corded bows for fishing, armed with three prongs; blunt spears, with barbs, and fish spears ornamented with feathers; lines of sea-weed or kelp, with detachable spear-heads; throwing-sticks, to give a longer leverage in projecting the spear. There are also chisels for making apertures in the ice, to which fish resort for air; dog sledges, canoes, paddles, reindeer skin overcoats and boots; an overall perfectly waterproof, and exceedingly light, made

of the intestines of the seal, the edges being sewed or cemented, and the whole ornamented with tufts of hair or feathers in brilliant colors. Glimpses of in-door arts and employments are obtained from specimens of carvings, baskets, woven articles, sewing, paintings, and implements, together with the ever-present pipe, of which there is one with a decorated stem, carved by a Colosh. The illustrations are further extended by wooden trays and dishes, ornamented with carved figures of animals; water-tight baskets, in which provisions are boiled by dropping red-hot stones into the water; mats of simple checquer pattern; carved handles of the black horn of the Rocky Mountain goat, exhibiting an intricate series of ornaments, and fastened by the aid of heat and pressure to the broader horn of the moose, or of the Rocky Mountain sheep, to form a spoon or a ladle. Among the carvings is a remarkable series in walrus ivory of objects in miniature, representing table knives, spoons, candlesticks, boiling kettles, with covers, copied from objects introduced by foreigners; also the animals of the country, such as beaver, moose, whales, seals; a female otter followed by her young; likewise a man spearing a bear; a group of men attacking a reindeer, and several other human figures. These miniature specimens of carvings, which are executed with great neatness and fidelity, evince a minute observation of nature, as well as considerable skill in art. A Colosh painter's kit belonging to this collection, contains a number of brushes very neatly made and of sizes suitable for fine or coarse work. Although the assortment of colors is small, being limited to red, blue, yellow, and black, yet the whole collection of specimens relative to art shows an advance in this line beyond anything before observed in the northern races. Among other articles is the dance rattle, commonly used by the coast tribes, and consisting of a hollow, oval, wooden box, usually in the form of a bird, gaily painted, containing pebbles; also head ornaments, of grotesque form; head dresses, with wooden masks, having distorted features; likewise ornaments of stone finely executed, and representing birds, fish, and serpents in the form of a ring; besides numerous samples of the same in wood and bone.

From Lieutenant T. M. Ring, United States Army, stationed at Fort Wrangel, in Alaska, we have received an important collection of objects, among which are models of the *bardoska*, or canoe, with paddles, of very neat workmanship; the head of a fish spear, and several bullets made of copper; two fish-hooks of a metal resembling silver, and halibut hooks of wood; also two specimens illustrating the form in which provisions are preserved for winter use, one of which is a spherical ball of the fruit of *Rubus chamamorus*, and the other is the compressed inner bark of a coniferous tree, which may serve to allay hunger by distending the stomach. A stone hammer and two pestles are samples of articles still in use, and an ancient barbed and notched bone fish spear exhibits the forms of similar implements discovered in the prehistoric caves of Europe. A full series of carved wooden dishes

and of horn spoons illustrate the table service of the natives, while masks, rattles of wood and of basket-work, neck and lip ornaments of stone, a dressed doll with a head carved in stone, a human image, and a bird of the same material, exhibit some of the occupations and amusements of this primitive people. From Mr. E. E. Smith, of the scientific corps of the Western Union Telegraph Company, the Institution has received a bow and arrows of the Smagamut Indians, for shooting wild geese; and from Dr. A. H. Hoff, United States Army, a very fine sample of the membranous waterproof dresses used by the Alaskans, also a pair of carved chop-sticks of whalebone. The latter articles were received through the officers of the Army Medical Museum.

Washington Territory.—From this quarter we have obtained collections made by Dr. J. T. Ghiselin, United States Army, stationed in Washington Territory, consisting of bow, quiver and arrows in use among the Flathead Indians; also, a number of arrow-heads and a pair of moccasins, collected among the Cascade Indians; we have also a riding whip, wedding hat or bonnet, a berry basket, and specimens of food preserved for winter, consisting of the eggs of the salmon, of the size and consistence of dried peas. Dr. Whitehead, United States Army, also transmits from the same region some bones exhumed from a shell mound, and a metal spoon from an Indian grave.

Idaho Territory.—From among the Nez Percés, Dr. E. Storror, United States Army, has collected specimens of preserved food, consisting of the bulbs of the camas, *Scilla esculenta*, and the kouse bread, an unleavened mass, an inch thick, of the seeds of wild rice, *Zezania aquatica*, pounded up with water, and baked. Accompanying these are spear-heads of flint and iron, strong hair rope or lariat, a woman's saddle, blanket, panniers, a drum, a carved pipe stick, and a handsome pipe of red stone, a skull cap of woven grass, a comb, sewing awl, thread, an ornamented belt worn by a woman, and a model of a cradle, affording glimpses of domestic life. Dr. C. Wagner, United States Army, has forwarded a bow, quiver, arrows, and arrow-heads, obtained from the Snake Indians; and Hospital Steward E. Lyons, a basket, woven scoop, and bow and arrow from the same tribe. From Montana, Dr. R. B. Hitz has transmitted a stone pestle.

Utah Territory.—Dr. H. E. Waters, United States Army, stationed at Fort Bridger, in Wyoming Territory, has collected and forwarded some of the implements of war and the chase used by the Shoshone, Bannock, Ute, and Navajo Indians, consisting of a bow and arrows, a bow case, quiver, tomahawk, and war club. The arrows of the Navajos are said to be poisoned. From Dr. Meacham, United States Army, have been received fragments of pottery found in the same Territory.

Oregon Territory.—Dr. C. Moffat, United States Army, has presented a small but interesting collection from Oregon, near the vicinity of Malheur River and the Stein Mountain. In it we find the bow, quiver, and arrows of the Malheur River Indians, a drinking cup, fire stick, paint

bag, carved wooden comb, and beads; also a specimen of preserved food, consisting of camas root, dried and compressed into a thin cake. These Indians are somewhat away from the beaten route, and everything from them is of much interest.

California.—From mounds in Alameda County, California, examined by Dr. L. G. Yates, who has frequently contributed articles of interest from that State, we have received many specimens of the ancient stone age, consisting of stone pestles, perforators or awls, sinkers, a phallus, spindles, a soapstone ladle, stone mortar and pestle, pipe bowls, shell and perforated stone ornaments, an ancient awl and serrated implements of bone. The race of Indians at present occupying the country are said to be entirely ignorant of the art of making these objects and of their use. From the Pott River Indians, California, Dr. Powell, United States Army, has sent a bow, quiver and arrows; and from the Pah Utes of Owen's Valley, California, we have similar weapons from Dr. Th. McMillan, United States Army, who has likewise contributed a war club of the Mohaves.

Nevada.—Clarence King, esq., director of the United States geological survey in Nevada, presented a portion of a beautifully worked pestle of syenite, obtained in Lower California.

Dakota.—The post surgeons stationed at the military posts on the Upper Missouri, chiefly within the Territory of Dakota, have shown much zeal in collecting objects to illustrate the pursuits and customs of the numerous tribes occupying the country bordering on this river. First among these, in point of interest, are the collections of Surgeon C. C. Gray and Dr. Matthews, United States Army, stationed for some time at Fort Berthold. From the Mandans they have furnished a head dress mounted with buffalo horns, with an ornamental pendant of dressed buffalo hide falling behind the head; a war shield of the Gros Ventres, with bow, case, quiver and arrows, in the highest style of Indian ornamentation; a bow of the Arickarees, ingeniously fashioned of an elk horn; a stone hatchet from the same, together with the scalp taken from a Blackfoot Indian; also from the Yanktonnais Sioux, a hoe, made of the shoulder blade of an elk, accompanied by a wooden saddle and appendages, a pad saddle, a whip with a horn handle, parfleche meat case, sheath for a scalp knife, and a rake of wooden material. The Mandans and the Berthold Indians generally, are addicted to gambling, and accordingly in the collection there are dice, and a small basket to contain them; also the gambling implements in use among the women; and, finally, a wheel or roulette, the workmanship of Gros Ventres. There are also domestic implements of the same tribe, consisting of a basket for carrying provisions, a wooden desk, an earthen pot, implements of bone for scraping skins, with horn spoons and ladles; several medicine rattles, indicating the superstitions of the tribe, and a musical instrument of their invention, illustrating the innate tendency to cultivate the fine arts; while children's toys, including a popgun, not unlike those

in use among the whites, show the unity of intellect among races the most widely separated. A needle case, porcupine quills, and bead ornaments, together with a corn bag, illustrating female occupation, are from Hospital Steward J. E. Jones. From the same Territory, Dr. J. P. Kimball, United States Army, has contributed a large number of objects, such as the bow, quiver and arrows of the Assiniboines; also of the Sioux, Mandans, and Arickarees; scalpknife, sheath, and scalp, of Yankton; war club, bonnet, shirt, and leggings, drum, and other fighting equipments; a fleshing knife for dressing skins, a pemmican mallet, wooden cups, dishes, ladles, spoons, pipe and stems, a peace pipe of the Blackfoot Indians, two pairs of ornamental moccasins, and an ornamented dance rattle. From Fort Wadsworth, Dr. A. J. Comfort, United States Army, has sent a bow, case, quiver and arrows; a collar made of bears' claws; an ornamented sheath for knife; stone hammer; stone spear and arrow-heads; several riding whips; the instruments used in games of ball; a perforated horn implement from a mound; two red stone pipes with carved stems; three ornamented pouches of beaver and other skins; a stone palm thimble for sewing with a large needle; a worked quilt, a bunch of perfumed dried grass, scalp feathers, and a gourd dance rattle, which closes the list. From the Upper Sioux, Dr. James F. Boughter, at Fort Dakota, has obtained for the Institution from the Sioux a bow, with case and arrows, leggings, embroidered with beads; saddle cloths handsomely ornamented, riding whips, war feathers, knife sheath, moccasins, ear rings, &c., the trappings of the warrior. Dr. A. B. Campbell, United States Army, contributes from the Yanktons a handsome necklace of the claws of the grizzly bear; a smoking pipe; war club armed with knives; stone war mace; stone hammer or mallet; a mortar and pestle, the former made of a stout piece of buffalo hide gathered at the corners; with the usual bow and arrows of this tribe, and three arrows of the Kaw Indians. From the vicinity of Fort Randall, Dr. G. P. Hardenburgh has obtained for us another head dress of buffalo skin with the hair on, and surmounted by the horns, with a broad pendant of skin furred and feathered to hang down the neck; also a rubbing stone for dressing skins, and a horn spoon.

Dr. Gardner, United States Army, has forwarded from the same Territory a Chippewa bow, quiver and arrows, saddle, drum and sticks, a Sissiton pipe stick, medicine bag, bow, and a heavy scraper of bone, used in dressing skins. Dr. W. H. Forwood, United States Army, has contributed a bow, bow case, quiver and arrows of the Cheyennes, also arrows from the Sioux; Dr. H. G. Schell, United States Army, from near Fort Laramie, has sent a collection consisting of the bow, bow case, quiver and arrows of the Ogalalla band of Sioux; Dr. C. S. De Graw, United States Army, a bow and quiver of the Kiowas; Dr. A. Muller, United States Army, a hickory war bow of the Yanktons and Sissitons. From the same tribes a battle ax and pouch has been presented by F. B.

McGuire. Brevet Brigadier General Crane has contributed a pair of moccasins and a pipe of the chief Little Bear; Dr. A. Muller sends from Fort Ridgely arrows used by the Yanktons, Sissitons, and Upper and Lower Sioux. Mr. W. L. Toole, from the same Territory, has furnished a handsome red stone pipe, stone ax, chisel, and a stone war club or *casse-tête*.

Upper Missouri River.—From this region, Captain Little, United States Army, has contributed a slab of sandstone, upon which the impression of two human feet are rudely carved. Mr. Leopold Biddle, a stone chisel; and Dr. F. V. Hayden, a very perfectly preserved soapstone vessel, fragments of pottery, arrow-heads, and other objects from the site of an ancient Pawnee village.

Nebraska.—From Nebraska, Dr. S. M. Horton, United States Army, has furnished several important and interesting articles from the Ogalalla band of the Sioux. Among these are a buffalo robe, as prepared by the Cheyennes; a saddle from the Crow Indians; a Sioux war club; a pouch, knife and sheath, and a bunch of feathers, used in taking scalps; specimens of arrows of the Crows, Sioux, Cheyennes, and other tribes; several pairs of moccasins, and a skin prepared for making others; a gun case of Sioux construction; a riding whip; a lariat; provision case of tanned buffalo hide; tanned skins of the Rocky Mountain sheep and of the elk, and smaller articles consisting of several stone pipes from the Arapahoes, a paint bag and a comb, used by the Crow Indians, the latter made of the stiff appendages on the tail of a porcupine.

Kansas.—From the vicinity of Walnut Creek in this State, we have received through Dr. G. M. Sternberg, United States Army, the burial case and its appendages of a male Cheyenne child about three years of age. The wrappings enveloping the body, and the articles of dress, ornament, or daily use which accompanied it, form the most curious and interesting assemblage of objects of the kind we have ever received. The burial case is made of long flexible withes of willow, stripped of the bark, and lashed together somewhat in basket fashion, built up from an oval base, five feet in the longer and three feet in the shorter diameter, the sides and top being arched and rounded, rising about three and a half feet from the base. An opening on one side is left for the introduction of the corpse and a large number of articles of the greatest value to the Indians. These articles consisted of seven highly-finished and valuable buffalo robes; six blankets, white, red and blue; a hood, ornamented with beads; a cape; several worsted scarfs; belts, ornamented with beads and metal disks; a leather belt, covered with metal buttons; apparently all the child's wardrobe, as jackets, underclothes, stockings, moccasins, fur cap, leather gloves; together with a small tin dish, beads, metal plates, ornaments of German silver, and others made of the shells of the haliotis, which is not found nearer than the Pacific coast. There were also several articles which can scarcely be recognized as the property of so young a child, such as spur straps, tobacco pouches, hide

lariats, paint bags, and an oblong piece of stout bull hide. It is the opinion of Dr. Sternberg, that this sepulchral offering of valuable effects was not solely from the immediate relatives of the deceased, but that being the lineal descendant of a great chief, and heir to his rank in the tribe, many families or bands being present at the burial, contributed of their wealth to signalize their connection with the child's family, and the widespread sorrow at the loss they all had sustained. A full account of this interesting collection, with drawings of the articles, has been prepared for publication by Dr. Otis, of the Medical Museum, in the Institution Contributions to Knowledge.

From Fort Harker, Kansas, Dr. E. B. Foyer, United States Army, has presented a number of the arrows used by the Kaws, Apaches, Cheyennes and Kiowas, which are commonly pointed with iron, and have the feathered end painted with the adopted colors of the band or tribe, so that they can at once be recognized by Indian scrutiny.

Colorado Territory and Adjoining Regions.—The collection of ethnology has also been enriched, through the Army Medical Museum, by specimens from the tribes which occupy the plain on both sides of the Rocky Mountains in Colorado, New Mexico, and Arizona. Dr. B. A. Campbell, United States Army, from the first-named Territory, has sent a singular neck ornament, made of turtle shell, and two fine pouches of mink skin for holding tobacco. From the Kiowas, Dr. W. H. Forwood, United States Army, has presented a whip, a pipe, and a medicine rattle; Dr. F. G. A. Bradford a tobacco pouch, an earthen water vessel, a Navajo necklace, a pair of Cheyenne moccasins, claws of the grizzly bear, and a pair of Sioux moccasins. Dr. Lippincott, United States Army, from the Comanches has presented a whip, and Dr. J. Readles the hat of a medicine man, and a wooden spur. From Twin Springs, near Fort Fetterman, Dr. C. Sutherland, United States Army, has contributed two fine stone lance-heads, and Dr. H. S. Schell six Sioux arrows. Dr. P. Moffatt has presented a bow, neatly made and covered on the convex side with the skin of a rattlesnake ingeniously cemented to the wood. From Mr. James Stevenson, of Dr. Hayden's corps, we have a very fine Arapaho saddle, padded and ornamented with beads. To these may be added several arrows of the Apaches and Comanches, presented by F. B. McGuire, esq., of Washington City.

In New Mexico, the Navajos are the most troublesome Indians that reside within the present boundary of the United States, and in the numerous conflicts between them and our military forces many interesting objects have been captured. Dr. John Brooke, United States Army, has procured for us, from Fort Sumner, Navajo bows and arrows, a bridle bit, and a pair of moccasins; Dr. B. A. Clements, United States Army, a lot of arrows; Dr. J. T. Weed a saddle blanket, shield, two bows, bow-case, quiver and arrows, a belt, and a curiously made shield for the back; Dr. McKee, United States Army, a bow case, quiver and arrows, a rough stone implement for dressing skins, and an earthenware dish.

Mr. M. Kayser, of Santa Fé, has contributed from the same tribe a blanket made of the wool of the native sheep. From the Wachita battle ground, in the Indian Territory, Dr. Lippincott, United States Army, has obtained for us a lot of bows, cases, quivers, iron arrow-heads, metal tubes for nose ornaments, and finger rings of German silver. These all belonged to the tribes engaged in the conflict, namely, the Comanches, Arapahoes, Wachitas, and Kiowas.

From Arizona, the principal contributions in former years were by Dr. E. Palmer, acting as medical officer at the Indian agency. The articles presented last year, by the same explorer, were such as relate mostly to the domestic occupations of the Apaches—a pouch with bullets, bone for dressing skins, awls for sewing, resin for finishing bows and arrows, paint bag, with black and red pigments, the former color being derived from the inspissated juice of the mescal plant, and curious necklace, woven of strips of the inner bark, complete the collection. From Dr. John C. McFerran, United States Army, have been received a battle-ax; and from Dr. E. Coues several Apache arrow-heads. From the western part of the Territory Mr. Manning F. Force has sent a (syenite or porphyry) stone axe of symmetrical shape and beautifully polished. Mr. Henry C. Force, from the Gila River, has presented fragments of pottery and shell ornaments, and, from the Moqui Indians, a small, red, earthenware vase. Mr. H. C. Fernald has given a small stone axe, obtained near the same locality.

From Wisconsin, Dr. R. P. Hoy, of Racine, well known for his researches in aboriginal ethnology, has presented an ancient earthenware vase, nearly entire, having a conical or sugar-loaf bottom, with fragments of another vessel. Dr. Moses Barratt, of Waukesha, has sent numerous stone relics, axes, chisels, arrow-heads, and a stone disk; also an arrow straightener, consisting of two flat pieces of sandstone with semi-cylindrical grooves, through which the shaft is drawn when the stones are fitted together. He has also sent fragments, apparently of brick, which formed part of a wall so ancient as to be attributed to Aztec workmanship.

In Illinois, the Chicago Academy of Sciences, energetically engaged in promoting research in aboriginal remains, has had made electrotype copies of a fine specimen of copper knife, one of which has been presented, through Mr. H. Shimer, to this Institution; also a similar cast of a copper chisel, and a cast in plaster of a remarkable terra-cotta image. From Mount Carmel, Illinois, Mr. Robert Ridgway has presented two fine stone axes, several spear and arrow heads; and from the same place Mr. Granville Turner has sent a hoe of jasper, three spear-heads of chert, and a lot of arrow-heads; also from the same State, Dr. Hall has presented a stone axe, a chisel, and a number of arrow-heads; and J. E. Kendrick, of Des Moines, has contributed a series of specimens of pottery.

From Indiana, Dr. R. M. White, United States Army, has presented

a curious earthenware pipe and a dress ornament; Drs. McCoy and Maxwell, for themselves and friends, a collection of stone hatchets, spear-heads, and other stone relics. The most remarkable objects, however, from this State are from near Cannelton, and consist of two stone mace-heads or *casse-têtes*, of hard ferruginous quartz, perforated through their longer axes, polished and finished in a perfect manner. They were presented by Mr. Hamilton Smith, with other stone relics. From Franklin County, Indiana, Dr. R. Haywood and his friends and neighbors have favored the Institution with a considerable collection of stone implements, many of fine workmanship, among which may be enumerated stone pestles, axes, chisels, spears, and arrow-heads, stone ornaments, and pottery.

From Ohio, Mr. W. R. Limpert has contributed a collection, found at Graveport, of well-finished articles; consisting of a variety of stone pestles, a mortar for grinding paint, a number of stone knives or chisels, and axes, a perforated stone disk, over one hundred arrow-heads, a stone awl, and other miscellaneous objects in stone. From Rev. Dr. Thompson, at Milnersville, Ohio, we have received arrow-heads collected in his vicinity.

From Kentucky, Mr. S. S. Lyon, whose archæological researches in 1868 were of such interest in the mounds of Union County, has forwarded additional articles, consisting of shell disks ornamented by carvings, a fishing sinker of the same material, perforators of stone, and small masses of galena worked into a rounded bead-like form.

From Tennessee, Mr. S. L. Wilkinson, near Clarksville, has sent five spear-points, a large number of arrow-heads, a stone disk, and a mortar for grinding paint. Dr. Curtis has also favored us with a lot of arrow-heads from Knox County. We have likewise to record the liberal donation, by Mr. J. H. Devereux, of a very valuable series of stone implements and other objects, collected by himself, chiefly in Tennessee, though some of the articles were obtained in other Southern States, as well as a few from Ohio and Massachusetts. The perfect condition and fine finish of these articles are remarkable, and they are so numerous as to fill a separate case. They consist of every variety of form of axes, chisels, gouges, knives, spear and arrow-heads, pipes, ornaments for the person, of stone and of pottery articles, many of which are entirely unique.

From Arkansas, Mrs. Governor Throckmorton, of Little Rock, has presented a pestle, grinding stone, and two paint mortars; and from the same State, Mr. J. M. Stanley has sent a quantity of quills of the porcupine, colored for use by the Indians in their embroidery.

In Mississippi, Mr. T. J. R. Keenan, of Brookhaven, has shown zeal in examining the natural and ethnological curiosities of his vicinity, and has presented to us a large number of handsome arrow-heads of brown jasper, a curious cylinder of the same mineral, a stone disk, and a pair of ear pendants made of silver coins by an Indian boy.

In Louisiana, opposite Vicksburg, Dr. E. Swift, United States Army,

has examined the contents of several mounds and Indian graves, from which he obtained for us many interesting articles, the principal of which are earthenware vases in good preservation and of curious forms, approaching that of the vessels common among the tribes of Chili and Peru, evidently for holding water, most of them having very narrow openings, and being spherical in shape; also, stone hammers, chisels, pestles, carved pipes of sandstone, a disk of quartz, bowls and cups of earthenware, &c.

In Texas, Dr. D. H. McElderry, stationed at Fort Griffin, has assiduously collected from the tribes near his post many objects of interest; among which we may enumerate three Comanche war shields painted and ornamented, bows, bow case, arrows, quiver, scalp knife, and sheath, war drum, tomahawk, and riding whip, all of which belong to a warrior's equipment. The other articles are implements for dressing skins; tinder bag; dance ornaments; two head dresses, one made of Comanche hair and the other of a bear's ear; a girdle and pouch made of a Comanche's skin; a square girdle and arm and head ornaments, some of silver plates, with toy bows and arrows, and two rag dolls decorated with Comanche hair. Dr. J. Middleton, of Camp Verde, has presented a saddle obtained from the Kickapoos, and Mr. George Kean, some bony plates of the *Lepidosteus*, or great western gar, having been used by the southern and western Indians as arrow-heads; a fact in accordance with a statement of William Bartram in his travels in Florida during the last century.

In Florida, explorations have recently been made in the shell heaps near Tampa Bay by Dr. William Stimpson and Mr. E. C. Stearns. From the former we have received a curious shell implement formed of the columella of the great *Fasciolaria gigantea*, the use of which is unknown. From Mr. Stearns, a large soapstone vessel, a stone sinker, a spear-head and fragments of pottery. Mr. H. Clark, of the same place, has presented several hammers, a fishing sinker, a number of arrow-heads, and an earthenware vase.

From Alabama, we have received specimens of arrow-heads, principally of jasper or agate, and of good finish, presented by Mr. Isaac Slee, of Baldwin County, and specimens of the same kind from Mr. Henry C. Force, collected in Northern Alabama, and also specimens of pottery and arrow-heads presented by Dr. Reynolds, United States Army.

From Georgia, at St. Simon's Island, a favorite station of the Southern tribes, Dr. C. H. Taylor, United States Army, has forwarded a number of stone axes and arrow-heads, and also pottery from Brunswick County.

From Virginia, Fayette County, Mr. A. G. Grinnan has presented a collection of stone axes, hammers, chisels, and a finely formed fishing sinker made of hematite, of which we have several specimens from localities widely separated, the weight of the material being its great recommendation for this service. Mr. E. C. Meade, of Albemarle

County, has given an Indian hatchet and a lot of arrow-heads. Major H. C. Williams has presented arrow-heads from Fairfax County; Mr. Robert Burford, arrow-heads from Isle of Wight County; and from Mr. C. R. Moore we have received a fine lance-head, a pipe, pipe-stem, and arrow-heads, found on the east shore of Virginia.

From North Carolina, Rev. M. A. Curtis, of Edgecombe County, has presented two stone axes, a collection of arrow-heads, and specimens of pottery.

District of Columbia.—From Mrs. M. H. Schoolcraft, of the District of Columbia, to whose liberality we were previously indebted for large collections, we have received additional specimens of stone hammers, a stone disk, and other implements. From the Agricultural Department we have received a very perfectly finished war mace with handle, its locality being unknown. Contributions of specimens from the District of Columbia, were made this year by Joseph Saxton, esq., of the United States Coast Survey. They include very numerous examples of all the usual stone implements, such as axes, chisels, hatchets, gouges, spear-heads of very great size, tomahawks, several perforated stone implements, disks, a vessel carved out of soapstone, and a great number of arrow-heads collected on both sides of the Potomac River, and of every variety of material accessible to the Indians, mostly of quartz and quartzite, slate, jasper, &c., with a large quantity of pottery fragments.

From Maryland, Mr. F. B. McGuire, of Howard County, has presented numerous arrow-heads; a lot of the same collected at West River has been given by Mr. W. Q. Force. Dr. C. Sutherland, United States Army, has presented a stone battle ax and arrow-heads from near Annapolis, and Mr. John Cameron, of Prince George's County, has given us a collection of over a hundred arrow-heads, neatly arranged for exhibition. From Charles County, we have received from Mr. O. N. Bryan, an industrious collector, many objects of this class, such as stone knives, chisels, spear-points, pestles, hatchets, awls, and a variety of Indian pottery. From the same vicinity, Mr. James Slagle has presented arrow-heads and a quantity of fragments of pottery.

Pennsylvania.—Mr. J. H. McIlvaine, an ardent inquirer into the manners and customs of the aborigines, has presented a fine stone ax and a stone tomahawk from Northumberland County, a flanged stone ring or wheel; a stone wrought into the form of a bird; a slate chopping-knife and a breastplate of shells and beads, with specimens of pottery. From B. Smith, Upper Darby, we acknowledge the receipt of a stone ax and some arrow-heads; from R. Christ, at Nazareth, Pennsylvania, two stone chisels and an ax; from Harry Hoover, a flint knife and arrow-heads, collected in Clearfield County; and from Dr. E. Michener a soapstone dish, a hoe, a number of axes, chisels, pestles, a lot of arrow-heads, a tomahawk, and a polished ornament for the neck.

From New Jersey, at Shrewsbury, Mr. Samuel Wilson has sent us a

number of stone axes, chisels, and arrow-heads, a stone tomahawk, paint mortar, and pipe. From Tuckerton, Mrs. Lewis Blackman has presented a stone hoe, a sinker, numerous arrow-heads, and other stone implements. To Isaac Lea, LL. D., of Philadelphia, we are indebted for a very fine stone ax found in New Jersey.

From New York, Messrs. S. P. Forman and R. Howell, near Nichols, have contributed ethnological articles, consisting of stone fleshing chisels, arrow-heads, and flint knives; and also, from Mr. Merritt, near Farmingdale, we have a number of arrow-heads. From Western New York, Dr. F. B. Hough, a diligent coöperator and accurate observer, who long since began to make contributions to the Institution, has forwarded from his extensive collections a number of interesting objects. We may mention a bowl, or deep dish, carved in soapstone; a stone mortar, a number of pipe-bowls, pipes, &c., with chisels, spear-heads, gouges, and an Indian cradle profusely ornamented.

From New England, Mr. S. A. Ladd, from the vicinity of Meredith Village, New Hampshire, has contributed a considerable variety of stone implements, including two of those remarkable chisels, or gouges, having a curved cutting edge; also straight chisels, spear-heads, pestles, fishing sinkers, perforated stone ornaments, and arrow-heads. From Vermont, sent by Messrs. J. M. Currier, W. G. Norris, and R. Wheeler, we have received a spear-head of native copper, of good workmanship, but much corroded. The metal of this may have been obtained in barter from the Indians of Lake Superior, or from others living in Nova Scotia, where the native metal exists. It was accompanied by a stone hoe, a flat, triangular implement with a cutting edge, of which examples are somewhat rare, stone pestles, and lance-heads. Mr. Fearing Burr has presented a cast in plaster of the most perfectly shaped pestle yet obtained, which, at the end grasped by the hand, is worked to a sharp edge or comb, pointed at one side. It was exhumed from an ancient Indian cemetery near Hingham. Very large collections of stone implements have been received from Dr. W. Wood, of East Windsor Hill, Connecticut, who has devoted much time and exhibited great zeal in this branch of research as well as in others connected with natural history. A liberal donation is recorded from him of axes, hammers, chisels, spear-heads, knives, gouges, pestles, perforated stones and hoes, and from these and other parcels received from him, it may be justly inferred that his vicinity was densely populated in former times by the savages who wrought these articles.

Canada, New Brunswick, &c.—Much attention has been excited in the Dominion of Canada upon the subject of aboriginal remains, chiefly through the exertions of Principal Dawson, of McGill University, Montreal, from whom a valuable series of Indian pottery, pipes of stone and earthenware, perforated stone implements, &c., has been received. Professor L. W. Bailey, of New Brunswick, also has presented several stone axes, strings of wampum, spear-points, and arrow-heads, which

were collected in his vicinity. From a long-esteemed correspondent of the Institution, Mr. W. E. Guest, formerly of Ogdensburg, New York, now of Canada, have been received a number of curiously-worked bone implements, chiefly awls or perforators, employed anciently in sewing leather garments and moccasins. An unknown donor has sent us a fine sample of the heavy stone mauls used by the mound builders or their predecessors, in mining the native metallic copper from the Lake Superior region, where the vast deposits of this metal were resorted to for the materials out of which to make spears, tomahawks, fish-hooks, sinkers, and personal ornaments.

Mexico.—From other districts not included within the United States, the Institution has received important contributions in ethnology. Dr. Sartorius, from near Mirador, in Mexico, has sent specimens of the stone implements and ornaments formerly in use among the aboriginal races of that country. Some of these, namely, the perforated ornaments, beads, knives, and chisels, are prepared from a variety of jade—a hard green mineral, held sacred by the natives—and others, such as knives, flakes and arrow-points, are of obsidian, a material from which long-bladed portions can be flaked off by a slight pressure on the sides of the core. The traditional knife for the rite of circumcision among the Jews was of stone, and the suggestion has been made by Dr. Foreman that the custom originated with a people living in Asia Minor or Arabia during the stone age. This collection also contains earthenware images, saucers, incensories, bowls, cups, candlesticks with and without handles, together with domestic utensils made of dried gourds, which are sometimes converted into children's rattles. All these are of modern workmanship and now in use among the people of the country. From Dr. Sumichrast, also of Mexico, we have received a perforated stone tube—probably part of a pipe.

Porto Rico, West Indies.—From Porto Rico, George Latimer, esq., who has long been a very liberal contributor to the collections of the Institution, has sent three additional specimens of remarkable elliptical stone rings, resembling an ordinary horse collar, made from a very hard syenite rock, and carefully sculptured and polished. It is suggested that they were placed on the neck of the human sacrificial victims during religious ceremonies, probably for effecting strangulation before the fatal stroke of the obsidian knife. One of them is of a different pattern, being shaped like a horse-shoe, or the letter U, and of more massive proportions. Included in this interesting collection are also several ancient stone chisels similar to those found in the United States, and a number of terra-cotta images of grotesque form.

From Barbadoes, West Indies, through the kindness of Granville Chester, esq., we have obtained several ornaments of carved shells and a hatchet of the same material. Articles made of shell are now exciting much interest, as this substance seems to have been widely employed at as early a period as that of the age of the mound-builders.

British Guiana.—P. Figyelmesy, esq., United States consul, has presented a valuable series of articles in use among the tribes of Indians now living in the interior of that country, including sets of bows and arrows, war clubs, a blow-gun, with two cases of arrows poisoned with the wourali; an emblem of office, consisting of a club and a paddle combined; a stone chisel, and also head dresses, made of brilliant-colored feathers, bracelets of the green and gold wing cases of a large species of beetle, (*Buprestis*,) beaded aprons worn by females, a necklace of the teeth of the peccary, and a flute constructed of the long bones of a wading bird.

From Central America, Dr. Earl Flint, while examining the Island of Ornatepé, in Lake Nicaragua, obtained for the Institution, from ancient tombs, an idol and three earthenware vases of much interest. From Chiriqui, an unknown donor has contributed an earthenware vase.

France.—The prehistoric caverns and rock shelters of France, under the persevering investigation of Professor E. Lartet, have yielded such a harvest of precious relics, and of ingenious and interesting deductions, as to have conferred on him a world-wide renown. Out of his abundant materials he has with much liberality presented to the Institution several cases filled with objects, of which it will suffice to enumerate a few prominent specimens. Of the animals contemporaneous with man in those obscure times, there are bones of the horse, some of them gnawed by wolves; of the aurochs, rhinoceros, wild goat, chamois, hyena, reindeer, including a very perfect jaw and teeth of the cave-bear. Associated with these are two small bones of the human skeleton, apparently belonging to the phalanges of the hand. Among the implements of war, of domestic use, and articles of ornament, are casts of bone implements, chiefly for making perforations, stone knives, sculptured horn of reindeer, and bone aigrettes, probably for fastening skin or fur dresses; also a mortar for grinding grain or fruits, and casts of arrow-heads, in forms very similar to those of American specimens; and many flakes of flint struck from the core while making knives, arrow-points, or other articles. The European flint is better adapted to this manufacture than any stone found in America, except obsidian. These flint chips were gathered from fourteen different localities in France, indicating the prevalence of the art of forming cutting implements of stone and the density of the population. Professor Lartet has also contributed several large masses of the breccia which occupies the floor of the caves, consisting of bones and teeth of animals, flint flakes, pebbles, and other objects cemented together into a solid pavement. The composition of these masses apparently indicates the great antiquity of man, since they present the stone implements of his construction embedded in the same materials with the bones of the rhinoceros and other extinct animals. The most remarkable portion of this collection may, however, be said to consist of the illustrations of the art of sculpture as it existed among the prehistoric races. The material

employed was the broad portion of the horns of the reindeer or the ivory tusks of the elephant. These carvings exhibit a remarkable appreciation of form and composition, undoubtedly derived from constant observation of the wild animals depicted. They chiefly represent the more remarkable quadrupeds, such as the elephant, reindeer, bear, aurochs, &c. These are all exhibited in motion or in striking attitudes, such as leaping, fighting, or flying from pursuit.

Polynesia.—It is proper here to record an addition to the collections from Commodore John H. Aulick, United States Navy, consisting of a large cape or mantle entirely covered with brilliant plumage of scarlet, gold, and black feathers, derived from birds which are extremely rare in that country. It was made for the personal decoration of King Kamehameha on state occasions, and presented by his Majesty to the commodore when he officially visited the Sandwich Islands, some years ago. From Commodore Magruder, United States Navy, we have received several warlike implements of the Feejee Islands.

METEOROLOGY.—The system inaugurated at the beginning of the Institution has been carried on as usual during the past year. The whole number of observers reporting to the Institution during this period has been 479, and to the Medical Department of the United States Army, 120, making in all 599. Among these, 167 report indications of the barometer and the other instruments, and the remainder those of the thermometer, rain-gauge, and wind-vane. Owing to the necessarily unsettled condition of the army since the war, many changes have taken place in the posts at which observations are made, and therefore the permanent, or, rather, normal condition of the whole system has not yet been established. I say "normal" because, since the observations made for the Institution are from voluntary observers, and some changes must take place in the disposition of troops, therefore more or less variation in the number and locality of points of observation must always occur, and a condition of absolute permanency is not to be expected. Nearly all the material that has been collected by the Institution during the last twenty years is in the hands of computers, with the exception of that relative to the rain-fall, which has been discussed and of which the results are now passing through the press. The material relative to temperature has been put in charge of Mr. Charles A. Schott, and will be completed during the present year, provided the usual number of computers are retained. The discussion of the material relative to the winds of the northern hemisphere, collected by the Institution from various sources, is in charge of Professor Coffin, of Lafayette College, who, with a number of assistants, will press on the work of its reduction and discussion as rapidly as the means appropriated for the purpose will allow. The previous discussion of the winds of the same region by Professor Coffin, published in the transactions of the Institution, has been adopted as a part of the basis of the pilot charts of the British Hydrographic Office, which fact may serve as an indication of the value

attached to the publications of our Institution and to the labors of one of its collaborators. Few persons not having experience in the matter could imagine the amount of labor required in the reduction and discussion of physical observations. In the case of the observations reported to the Smithsonian Institution nearly three millions of figures have to be gone over. But this is not all. Various hypotheses have to be provisionally assumed, and the deductions from them tested by comparison with the actual results of observations, while many special results have to be deduced in accordance with previously established formulas. The result of the discussion of the rain-fall, besides being given in tables, is illustrated by curves and rain-charts. The printing of the tables is necessarily a slow operation, requiring special care in the correction of the proof. The printing of the charts has been facilitated by exhibiting the relative fall of rain in each part of the country by different depths of shading in the original engraving, the distinction being made more obvious by a second printing in a single color. The rain-charts are three in number; one exhibits the relative fall of rain for the whole year; another for the three months of summer; and a third during the months of winter. For agricultural purposes the rain-fall in the summer is most important, but data are given in the tables to ascertain it for every month of the year.

The distribution of rain is very materially affected by the prevailing direction of the wind, and this again is modified by the declination of the sun, a fact which must be evident when we consider that the motive power of the great currents of the aerial ocean is the greater heat of the equatorial regions derived from the perpendicular rays of the sun, which, expanding the air, causes it to ascend and flow over in each direction toward the poles. The medial line along which this expansion takes place must move north and south with the sun in his varying declination. If the earth were covered entirely with water, and were at rest, the currents of the air would be comparatively simple; but, since the earth is in a rapid rotatory motion eastward, the currents which flow at the surface toward the medial line move on one side from the northeast and on the other from the southeast, thus forming what are called the "trade-winds," while the same currents continued upward and northward on one side, and upward and southward on the other, curving eastward, form the great stream of western return-trades which in the northern hemisphere, in summer, continually flow over the United States, at a high elevation, and which waft the higher clouds eastward, giving a similar direction to the principal storms of every season. In midsummer, when the medial line we have referred to is carried northward by the northern declination of the sun, the upper current reaches the earth beyond the fiftieth parallel of latitude, and precipitates the vapor which it brings from the Pacific Ocean in the form of rain on the western coast of America, to the depth, at Sitka, of ninety inches. As the sun declines to the south the rain belt gradually descends along the

coast until it reaches, in diminished quantity, the southern portion of California. As the sun ascends again toward the north the rain also gradually returns northward, until it leaves almost entirely, during the summer, that portion of the western coast south of 50° north latitude.

The primary currents of air we have mentioned are modified by the varying relative temperature of the ocean and the continents. The capacity of water for heat being about six times that of land, the latter becomes relatively much warmer in summer and colder in winter than the former; and since the air at the surface of the earth tends to flow from the colder to the warmer region, there must be a tendency of the wind from the ocean toward the land in summer, and the contrary in winter; though this may not be powerful enough to reverse the general currents, it is yet sufficiently so to produce in them the modifications of a very perceptible character. In summer, the greater heat of the surface of the middle portion of North America keeps the return trade-current at a high elevation, and produces a surface current from the Gulf of Mexico, which, on account of the motion of the earth, assumes a direction from southwest to northeast, bearing with it the moisture which is precipitated in rain, principally throughout the region east of the Mississippi River. Were the earth at rest the same current would flow over the whole of the Mississippi Valley to the base of the Rocky Mountains, and the aridity of the western portion of this region would no longer exist.

In winter, when the upper current, after sweeping across the Pacific Ocean, ascends along the western slopes of the mountains, it precipitates its moisture on their crest in the form of snow, which, melting in summer, gives rise to numerous streams which, although not sufficient to irrigate all the region between the Rocky Mountains and the fertile country adjoining the Mississippi on the west, may yet, by well-directed enterprise, serve very much to circumscribe the arid regions in the Mississippi Valley, as well as to mitigate the droughts of the great interior basins of the mountain system.

In summer, the sun approaching, in its northern declination, a position nearly vertical to the extremity of the Peninsula of Florida, heats the land and produces inflowing and upward currents of air, charged with moisture, which, perhaps more frequently in the after-part of the day, falls in copious showers. In winter, on the contrary, the sun being far south of the latitude of Florida, the surface currents are almost neutralized, or tend to flow from the land, and, hence, the rain-fall at this season is much less.

In the region east of the Mississippi, including the whole Appalachian system, the direction of the surface wind is the same as that of the trend of the mountains, and hence both sides and crests of the latter and intervening valleys are covered with vegetation.

The region along the eastern coast of the United States is also supplied with vapor from the Atlantic Ocean, which is borne inland in all cases where an approaching storm gives rise to a wind from an easterly

direction. The preceding sketch gives a general explanation of the marked contrast between the rain-fall of the eastern and western halves of the United States.

Most of the records of meteorological phenomena which were made previous to a comparatively late date had for their object the determination of, what may be called, the statical condition of the weather in different places, or, in other words, the determination of the average atmospheric pressure, temperature, direction of the wind, and the fall of rain. A knowledge of these elements is of great importance in ascertaining the relative climates of different countries, particularly in regard to sanitary and agricultural considerations. In later years, however, systems of meteorology have been established having more especially for their object the record of the simultaneous conditions of the atmosphere in different portions of the earth, and the origin and progress of storms; that is, to discover, if possible, the dynamic principles which regulate the phenomena of the weather. Systems of this kind have been established in almost every part of Europe and in several parts of Asia, even in Turkey, in the East Indies, and in North America. These systems are not only intended to indicate the laws according to which the atmospheric disturbances are produced, but, also, to predict, by the aid of the telegraph, the weather that may be expected within a given time.

The Smithsonian Institution was the first to make use of the telegraph for this purpose. The state of the barometer and thermometer and the direction of the wind were received from the various telegraphic stations at 8 o'clock each morning and recorded on a large map fastened to a board, into which small iron pins were driven to support circular cards of different colors, which indicated the character of the sky and of the weather—whether cloudy or clear, raining or snowing. On each card was drawn an arrow, the direction of which could be varied by suspending the card from one of eight holes with which it was pierced. A glance at this map showed at once the condition of the sky and direction of the wind over the whole country, and knowing from previous observation the direction of the movement of storms, the weather could, in most cases, be predicted, frequently more than a day in advance. In Europe the prediction of the weather is founded on the probable direction of the wind at a given place as deduced from telegrams giving the maximum and minimum pressures of the air as indicated by the barometer. It has been found from observation that the wind which may be expected will blow nearly at right angles to a line joining the maximum and minimum pressure of the air, and that the face being turned toward the minimum point, the wind will come from the left-hand side. This rule, however, may be theoretically deduced from the movement of the air in the form of a cyclone, but will scarcely hold true in case of the storms observed in the eastern portions of the United States. The storms that visit the west of Europe are those which come directly from the ocean, where the cyclonal character of the

wind finds little disturbance from inequality of surface, while the storms on the opposite American coast have their origin far inland, and are subject to great changes of form by mountains or other obstructions in their passage to the Atlantic Ocean. The system adopted by the Institution for predicting changes in the weather was interrupted by the war, and since the restoration of peace the telegraph companies could not be induced to furnish the transmission of the necessary telegrams free of charge; and as this project was intended as a practical application of science and would require a much larger appropriation for its support than could be afforded by the Smithson fund, the proposition to renew the system has been allowed to rest. At the present session of Congress, however, a resolution was offered by Mr. Paine, of Wisconsin, which was adopted, authorizing an appropriation of $25,000 for a system of weather signals, especially along the northern lakes. The general direction of this system has been placed in charge of the Chief of the Signal Corps of the Army, General Myer. The plans which have been adopted for the carrying out of the proposed object have not been communicated to the Institution. We shall, however, be ready to give any advice or assistance in conducting the enterprise which may be required, and also to avail ourselves of any facilities which it may afford us in the study of the climatology of the northern hemisphere.

Respectfully submitted.

JOSEPH HENRY.

JANUARY, 1870.

REPORT

OF

PROFESSOR JOSEPH HENRY,

SECRETARY OF THE SMITHSONIAN INSTITUTION,

FOR THE YEAR 1870.

FROM THE REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION FOR THE YEAR 1870.

WASHINGTON:
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1872.

REPORT

OF

PROFESSOR JOSEPH HENRY,

SECRETARY OF THE SMITHSONIAN INSTITUTION,

FOR 1870.

To the Board of Regents:

GENTLEMEN: The year 1870 may be considered almost an epoch in the history of the Smithsonian Institution, since in this year Congress commenced to recognize the propriety of making something like an adequate appropriation to relieve the Smithson fund from at least a portion of the burden to which it has from the first been subjected in the maintenance and care of the National Museum. During the last session of Congress an appropriation of $10,000 was granted for the preservation and exhibition of the national collection, and also $10,000 toward the preparation of the second story of the building for the better care and display of the specimens, and an equal sum for each of these objects has been asked at the present session for the year 1871, and we are assured by influential members of Congress that the request will be granted. It cannot be otherwise than gratifying to the friends of science that Government has at length awakened to the importance of making provision for the independent support of a National Museum, which we trust will be worthy of the capital of the United States. The connection which has heretofore existed between the National Museum and the Smithsonian Institution has been alike prejudicial to both, although more than one-half of the income of the Smithson fund has been expended in maintenance of the museum; and notwithstanding that the Institution, in the prosecution of its legitimate objects, has collected many thousands of specimens illustrating the productions of the North American continent, the public museum has not yet, owing to the inadequacy of means, been such as might be expected from the reputation of the Institution or the character of our Government.

The National Museum was established previous to the acceptance by the Government of the care of the Smithson bequest, and consisted at first of the specimens of natural history and ethnology collected by the United States exploring expedition under Admiral Wilkes. Unfortunately, from a misconception of the terms of the will of Smithson, as now generally recognized, Congress directed the appropriation of the income of the fund principally to a museum, a library, a gallery of art, and other local objects, which, though important in themselves, did not comport with the liberal spirit of the bequest, nor with the income of

the endowment, which was scarcely more than sufficient to properly support any one of these objects. Had it not been for this misconception, it is not improbable that before this time Congress would have made a more liberal provision for the support of the National Museum, and the scientific operations of the Institution which have made it favorably known throughout the world would have been much more extended. From the first the organic law of Congress has, therefore, stood in the way of the full development of the plan of active operations of the Institution; and it has only been by the gradual enlightenment of the public mind as to the true character of the will of Smithson and the importance of the plan of active operations, that, step by step, and after upward of twenty years of continued effort, the latter has now a fair prospect of producing all the results which have been claimed for it.

As stated in previous reports, the library of the Institution has been incorporated, under certain conditions, with that of Congress. The land around the building presented to the Institution by the Government, and upon which at first about $10,000 of the income of the fund was expended, has been incorporated with the public reservation set aside for a park, and the cost of its keeping defrayed from the general appropriation for the maintenance of the public grounds. The establishment of a gallery of art by the liberal endowment of Mr. Corcoran obviates the necessity of anything further being done in this direction by the Institution.

Still the emancipation of the fund from local objects is not as thorough as could be wished. It would be better, in my opinion, that the public museum should be entirely separated from the Institution. The appropriations of Congress are frequently fitful, and the distinction between appropriations for the museum and for the Institution is not as manifest as is desirable. It is the wiser policy of the Institution to ask no appropriations from Congress for its own legitimate objects, in order that it may be kept entirely free from political influence. We must, however, be content, in the attainment of an object depending upon legislative enactment, with securing a part of what we wish, if we cannot obtain the whole.

Finances.—The following is a general statement of the condition of the Smithson fund at the end of the year 1870, or rather at the beginning of the year 1871:

The amount originally received as the bequest of James Smithson, of England, deposited in the Treasury of the United States, in accordance with the act of Congress of August 10, 1846	$515,169 00
The residuary legacy of Smithson received in 1865, also deposited in the Treasury of the United States, in accordance with the act of Congress of February 8, 1867	26,210 63
Making the bequest of Smithson	541,379 63

Additions from savings, &c., also in the United States Treasury, as a part of the original fund	$108,620 37
In Virginia State stock, $72,760, valued at	48,000 00
Cash on hand	21,477 81
	719,477 81

The income from the fund during the year 1870, including the premium on gold, was $43,363 12. This amount is $6,152 08 less than that for 1869, due to the difference in the premium on coin.

No interest has been received from the State of Virginia for 1869 and 1870. Up to 1870 the usual appropriation from Government for the care of the National Museum was $4,000, but for the fiscal year commencing July 1, 1870, this amount was increased, as we have before stated to $10,000. Of this sum $5,024 have been placed to the credit of the museum; the whole expense, however, of keeping the museum, irrespective of the interest on the building, amounted to at least $15,000.

The remainder of the income (excepting $508 16) was expended in publications, exchanges, researches, salaries, &c., and nearly $5,000 for repairs on the building.

Congress also granted, as previously stated, an appropriation of $10,000 toward fitting up the large hall for the better preservation and display of the collections; but of this nothing has been drawn during the year, the plans and other preparations for the improvement of the building not having been completed. From the foregoing statement it will be evident that the Smithson funds are in a prosperous condition, and that should Congress continue annually to make an adequate support for the museum, they would be sufficient on the part of the institution to extend its usefulness far beyond what it has yet accomplished.

As a part of the history of the Institution, and in justice to the generosity of one of its earliest friends, I may mention under the head of finance, that for many years during the controversy which existed between the regents and the contractors in regard to the building, James M. Carlisle, esq., of this city, acted as counsel for the Institution, and has subsequently given advice on points of law which have arisen in conducting the various operations of the establishment. These services, the usual charges for which would amount to comparatively a large sum, have been gratuitously rendered to the Institution; for which liberality I would recommend a special resolution of thanks by the Board.

Publications.—The publications of the Institution are of three classes—the Contributions to Knowledge, the Miscellaneous Collections, and the Annual Reports. The first consist of memoirs containing positive additions to science resting on original research, and which are gener-

ally the result of investigations to which the Institution has in some way rendered assistance. The Miscellaneous Collections are chiefly composed of works intended to facilitate the study of certain branches of natural history or of meteorology, and are designed especially to induce individuals to engage in studies as specialties, to which in leisure moments their thoughts may recur, and by observations and collections in relation to which they may not only contribute to their own pleasure but, also, advance the cause of science. The Annual Reports are published at the expense of the Government, with the exception of the illustrations, which are furnished by the Institution.

During the past year the sixteenth volume of the Smithsonian Contributions to Knowledge has been published and distributed. It contains 494 pages, and is illustrated with 73 wood-cuts and 19 plates. The several articles contained in this volume, which were also published and distributed separately, are as follows:

The Gray Substance of the Medulla Oblongata and Trapezium, by John Dean, M. D. 4to, pp. 80. Sixteen plates, five wood-cuts.

Results of Meteorological Observations made at Brunswick, Maine, between 1801 and 1859, by Parker Cleaveland, LL.D. Reduced and discussed at the expense of the Smithsonian Institution, by Charles A. Schott. 4to, pp. 60. Eight wood-cuts.

Results of Meteorological Observations made at Marietta, Ohio, between 1826 and 1859, inclusive, by S. P. Hildreth, M. D.; to which are added Results of Observations taken at Marietta, by Mr. Joseph Wood, between 1817 and 1823. Reduced and discussed by the Smithsonian Institution, by Charles A. Schott. 4to, pp. 52. Fourteen wood-cuts.

On the Gliddon Mummy Case in the Museum of the Smithsonian Institution, by Charles Pickering. 4to, p. 6. One plate.

The Orbit and Phenomena of a Meteoric Fire-Ball, seen July 20, 1860, by Professor James H. Coffin, LL. D. 4to, p. 56. Two plates, two wood-cuts.

On the Transatlantic Longitude, by Benjamin Apthorp Gould. 4to, pp. 110.

The Indians of Cape Flattery, at the entrance to the Strait of Fuca, Washington Territory, by James G. Swan. 4to, pp. 118. Forty-four wood-cuts.

The Seventeenth volume of Smithsonian Contributions, that for the year 1871, has also been printed, is in the hands of the binder, and will soon be ready for distribution. It consists of a single memoir of 602 quarto pages, presenting the result of an elaborate original investigation by Lewis H. Morgan, esq., of Rochester, New York, on the "Systems of Consanguinity and Affinity of the Human Family."

This memoir, of which an account has been given in a previous report, was first referred to a commission consisting of Professor J. H. McIlvaine and Professor William Henry Green, of Princeton, New Jersey, who recommended its publication, but advised certain changes in the method of

presenting the subject. After these modifications had been made, it was submitted to the American Oriental Society, and was by it referred to a special committee, consisting of Messrs. Hadley, Trumbull, and Whitney, who, having critically examined the memoir, reported that it contained a series of highly interesting facts, which, they believed, the students of philology and ethnology, though they might not accept all the conclusions of the author, would welcome as valuable contributions to science.

The investigations of Professor Newcomb, relative to a new orbit of the planet Uranus, in continuation of those relative to the planet Neptune, an account of which was given in previous reports, have been temporarily interrupted by the visit of the author to Europe to observe the total eclipse of last December, and to collect ancient observations for correcting the mean motion of the moon. These investigations were commenced as far back as 1860, but Professor Newcomb had so little time to spare from official duties, and had to depend so much upon himself on account of the methods to be employed, that four years elapsed before even the first formulæ for the perturbations were computed. The best accepted elements of the planets were first used, viz, those of Bouvard for Jupiter and Saturn, and those of Pierce and Kowalski for Neptune. The calculated places of Uranus and Neptune were found from these data to differ so widely from the true ones given by observation as to show that the elements of these planets which had been adopted were not to be relied on. A re-investigation of their orbits therefore became necessary. That of Neptune was made exhaustive. The magnitude of the corrections required in the old elements is shown by the fact that the longitude of the perihelion of Neptune was changed by about four degrees. This investigation was published by the Institution in 1865, and the tables for predicting the position of the planet were immediately adopted by the nautical almanacs of England, Germany, and this country, and afterward by that of France, so that the computations of Neptune's motion are now generally made from them.

The elements of Uranus were next so far corrected by a preliminary investigation, that, with the perturbations already computed, the motion of the planet from the time of its discovery in 1781 until 1862 was represented within a very few seconds of arc. On collecting the perturbations of Saturn there appeared to be considerable discrepancy between the old ones employed in Bouvard's tables and those since computed by Hansen. As there could be little doubt of the correctness of the latter, Professor Newcomb accepted them as the basis of a preliminary investigation of the orbit of Saturn, and obtained elements which represented its motion near enough for the purpose desired. The elements of Jupiter were found to be sufficiently near the truth. The old computations of the "first-order" of perturbations were then corrected, and to guard against the possibility of an error the perturbations were then recomputed by an entirely different method. After long study and labor

the author was enabled to devise a method more simple than any before employed, of which the quantities previously calculated furnished the basis, and which has the great advantage of being easily applicable to the perturbations of the second order. The results of the two computations have been found to agree very closely. The more important terms of the second order have been once computed, but will be gone over again to insure correctness. The most difficult part of the work is now completed. An appropriation has been made by the Institution for defraying the expense of the clerical labor which is required in preparing the tables and performing the other laborious arithmetical calculations necessary in reducing the abstract mathematical results to practical use.

Among the papers accepted for publication are three by Major General J. G. Barnard, United States Army. The first of these relates to the "Precession of the Equinoxes and Nutation as identified with the phenomena of the Gyroscope." All writers who explain the "Precession" in a manner intended to be more or less adapted to popular comprehension, assume or demonstrate certain elementary facts which are common to the general phenomena of the "Precession," and the movements of the philosophic toy, the "Gyroscope." The intention of this paper is to identify the phenomena, and to show that a common analysis leads, when properly adapted to the different circumstances, to their solution. As a matter of course, the introduction of the proper expressions for the external forces into the general equations of rotating bodies will give the particular equations for the special cases. In the Mécanique Céleste, are thus derived the expressions for precession and nutation; but the analytical process is difficult, and the point of identification of the phenomena with those of the gyroscope is, in this point of view, too remote to be interesting. In this paper, solutions primarily obtained for the gyroscope are subsequently made use of to develop all the facts of precession and nutation. By the methods employed it is incidentally shown that the phenomena of "deviation" in rifled projectiles may be explained.

The second paper by General Barnard is on the motions of a "freely suspended pendulum," and differs from other well known discussions of this problem in giving, as a preliminary, a simple explanation of the origin of the forces which, on the surface of the rotating earth, cause a progressive azimuthal motion of the plane of vibration; and furnishing the analytical expressions for these identical with those of Poisson obtained by other processes. These same expressions exhibit forces which more or less sensibly affect *all* motions of material bodies on or near the earth's surface, as *e. g.* the tidal currents, the winds, the trajectories of projectiles, &c. The expressions obtained for the pendulum are developed with much greater detail than has been done in previous works. The differential expressions for the vibrations of the so-called "spherical pendulum" are integrated by development into series, and expressions approximately accurate, obtained for the

azimuthal motion of the apsides of the quasi-elliptical orbit. Inasmuch as in all actual experiments with the freely suspended pendulum the vibrations soon assume the "spherical" character, these latter expressions are really important as corrections to the azimuthal motion properly due to the earth's rotation, and may explain the small variations from the latter which the experiments generally exhibit. It is believed that these corrections have never before been applied, or indeed actually put into simple analytical shape. It is further shown that if a freely suspended pendulum is made to swing through a great circle with very high velocity, the plane of its orbit remains invariable in direction, in space, and that in this phase the phenomenon is identical with that shown by a gyroscopic disk, as it was arranged by Foucault to exhibit the rotation of the earth.

A third paper by the same author is "on the Phenomena of Precession and Nutation as affected by the internal structure of the earth," and is an attempt to corroborate the dictum of Sir William Thompson, that the phenomena of the precession and nutation *do* authorize some conclusions—very limited, indeed—concerning the internal structure of the earth, inasmuch as it is proved that the very commonly received geologic hypothesis of a thin crust enveloping a molten fluid is inconsistent with the actual phenomena as observed.

As the basis of the argument, the theorem is analytically demonstrated that an entirely fluid earth (*i. e.*, entirely destitute of solid crust and without internal viscidity) would exhibit neither precession nor nutation. In other words, that the tilting effects of the solar and lunar attractions would be exactly neutralized by the centrifugal forces due to the tidal protuberances they develop. *Pari ratione*, if the *figure* of the earth yields *at all* to the attractions, the precession and nutation will be neutralized in exact proportion to the extent (as compared with a perfect fluid globe) to which that yielding obtains.

Sir W. Thompson has proved that even an earth entirely *solid must yield*, unless its rigidity to the depth of two or three thousand miles greatly exceeds that of steel; a *thin crust*, say thirty or forty miles thick, such as geological hypothesis attributes to the earth, if enveloping a fluid nucleus, would yield nearly as much as if the earth were entirely fluid. But the observed rates of precession and nutation conform almost exactly to the hypothesis of perfect rigidity. Hence, the hypothesis of a thin crust is *untenable*. Incidentally the fallacy of the experiment (with rotating spherical glass shells, containing water) and argument of M. Delaunay to invalidate the conclusions of Professor Hopkins and Professor Thompson is exhibited, and the opinions of Poisson concerning the internal structure of the earth are, according to the author, shown to coincide better with observed facts than those of any other physicist.

Another paper has been examined and accepted for publication entitled "The Secular Variations of the Orbits of the Planets," by John

N. Stockwell. If but one planet revolved around the sun its path in space would be a true ellipse, which would always be the same in form and position; but if several planets revolve at the same time around the central body, their mutual attraction will disturb the regularity of the elliptical motion. The mutual action of the planets on each other produces two classes of disturbance, one of which consists in a change of the motion of each planet in its elliptical orbit, in some parts of its path moving faster and in others slower than it would if undisturbed; the other consists of a change in the form and relative position of the elliptical orbit. The first is called the periodic inequalities, and the second the secular variations. They are, however, both periodical, though the first runs through its changes in a short time, while the latter requires centuries to complete its cycle. The object of the investigations of Mr. Stockwell is to determine the numerical value of the secular changes of the elements of the orbits of the planets of our system. Several partial solutions of this problem have been obtained by previous authors, but they have been approximations based upon data less perfect than that which is at present afforded in the discovery of the new planet Neptune, and the better determination of the masses of the other bodies composing our system.

The expense of the publication of this paper is defrayed by the liberal donation of $1,200 from a friend of science, who declines to allow his name to be mentioned. We cannot, however, permit the fact to pass unnoticed of this example of the high appreciation of the value of abstract science since it does honor to the intelligence and liberality of one of our citizens engaged in active business life, and may serve as an example to stimulate other donations of a similar character.

In several of the previous reports mention has been made of a grammar and dictionary of the Choctaw language, in process of preparation for the Institution by Dr. Byington, for many years a missionary among the Choctaw Indians. This work was finally submitted to the Institution for publication, but having been found on examination to require corrections it was returned to the author in order that these might be made. Before, however, this work was completed, Dr. Byington died, and his MS. was given for revision to Dr. Brinton, of Philadelphia. It was again submitted to the Institution and referred to a commission for critical examination. Dr. Brinton, however, not satisfied with the report of this commission, withdrew the memoir, and presented it to the American Philosophical Society, in whose transactions it has since been printed. No objection was made on the part of the Institution to this transfer, since it has been from the first a part of its policy never to expend any portion of its funds in doing that which can be done by other means.

It will be remembered that in 1867, at the suggestion and expense of the Institution, a geological exploration of a portion of the Louisiana coast was made by Professor E. W. Hilgard, of the University of Mis-

sissippi, mainly with a view to ascertain the geological age and mode of occurrence of the rock-salt deposit of Petite Anse. In the absence of definite data concerning the general geology of Louisiana, his observations on the formations of the coast (an abstract of which was published in the American Journal of Science, January, 1869) demonstrated, so far as the salt deposit was concerned, only the fact that in point of age it was anterior to the drift. The impulse thus given to geological research in Louisiana, however, soon led to further explorations. By subscription, and a special appropriation obtained from the commissioners of immigration of the State, the New Orleans Academy of Sciences raised a fund for the purpose of enabling Professor Hilgard to make a general geological reconnaissance of Louisiana, which was executed in May and June, 1869. This enabled him to communicate to the American Association for the Advancement of Science, at its Salem meeting, a general sketch of the geology of Louisiana. Almost simultaneously with the organization of Professor Hilgard's second exploration, steps were taken by the faculty of the University of Louisiana to secure legislative aid for a geological and physical survey of the State. The latter is now in progress, and the second annual report on the work will soon be published.

As regards the rock-salt deposit, Professor Hilgard's observations in Northern Louisiana point to the conclusion that it is but one of a series of cretaceous outliers, traversing the State in a northwest and southeast direction, and indicating the existence of an ancient ridge which must have exerted an important influence upon the physical conformation of the Lower Mississippi Valley. The remarkable gypsum and sulphur deposits of Calcasieu are likewise, in his opinion, referable to the same age. Professor Hilgard has nearly completed a final memoir on the geology of the Petite Anse region for publication by the Institution; the results of his simultaneous exploration of the Lower Mississippi and delta having been communicated to the American Association at the Troy meeting, and subsequently presented to the American Journal of Science.

Dr. Horatio C. Wood, of Philadelphia, having completed an elaborate work on the fresh-water algæ, principally of microscopic forms, presented it to the American Philosophical Society and also to the Academy of Natural Sciences of Philadelphia, but the expense of publication prevented either of these societies from undertaking it. It was therefore offered to this Institution, and after a critical examination has been accepted for publication. As a systematic description of the fresh-water algæ of North America it will form a complement to the great works on the marine algæ, by Dr. Harvey, published some years ago by the Smithsonian Institution. It will be copiously illustrated by drawings, made principally under the microscope and will serve to illustrate an obscure department of botany, as well as to furnish the means by which investigators of minute microscopic organisms may make the

comparison of fossil and recent forms, a subject which is now attracting much attention in Europe and America.

The eighth volume of Miscellaneous Collections contains the following papers:

1. Monographs of the Diptera of North America. Part IV. Prepared for the Smithsonian Institution by R. Osten Sacken. 8vo, pp. 358. Four plates and seven wood-cuts.

2. Catalogue of the Orthoptera of North America described previous to 1867. Prepared for the Smithsonian Institution by Samuel H. Scudder. 8vo, pp. 110.

3. Land and Fresh-water Shells of North America. Part I. Pulmonata Geophila. By W. G. Binney and T. Bland. 8vo, pp. 328, and 544 wood-cuts.

4. Arrangement of Families of Birds. Adopted provisionally by the Smithsonian Institution. 8vo, pp. 8.

5. Circular to Officers of the Hudson's Bay Company. 8vo, pp. 6.

6. Suggestions relative to Objects of Scientific Investigations in Russian America. 8vo, pp. 10.

7. Circular relating to Collections in Archæology and Ethnology. 8vo, pp. 2.

8. Circular to Entomologists. 8vo, pp. 2.

9. Circular relative to Collections of Birds from Middle and South America. 8vo, pp. 2.

10. Smithsonian Museum Miscellanea. Pp. 88.

The ninth volume of Miscellaneous Collections contains—

1. Bibliography of North American Conchology previous to the year 1860. Prepared for the Smithsonian Institution by W. G. Binney. Part II. Foreign Authors. 8vo, pp. 302.

2. Catalogue of Publications of Societies and of Periodical Works belonging to the Smithsonian Institution. Deposited in the Library of Congress, 1866. 8vo, pp. 596.

In accordance with the plan adopted by the Institution of furnishing facilities and means of identifying specimens of natural history in its different departments, an arrangement was made with Professor De Saussure, of Geneva, Switzerland, the highest authority on the class of insects known as hymenoptera, (of which the principal forms are wasps, bees, &c.,) to prepare a monograph of this part of entomology. Large collections have been sent to him for the work, to which he has devoted several years of gratuitous labor. The first part of the manuscript was completed in the French language in 1863, and for translation was placed in the hands of a competent entomologist, Mr. Edward Norton, of Farmington, Connecticut, who volunteered his services from a desire of advancing science. This part of the memoir was prepared for the press in 1864, but as Mr. Norton was obliged to be absent from the country several years, the printing was delayed until his return, in order that the proof-sheets might be properly corrected. By this time, however,

so much new material had been collected it was thought advisable to refer the work anew to Professor De Saussure, from whom it has again been received, and after having been a second time revised by Mr. Norton will soon be sent to the press.

The Institution in carrying out its original plan of the preparation of manuals of natural history, has thus made provision for publications on the coleoptera, lepidoptera, neuroptera, diptera, orthoptera, and hymenoptera. Of the few remaining orders, a similar monograph of the *hemiptera*, by P. R. Uhler, esq., has been prepared, and will be published when the funds will permit.

For many years the Institution has intended, in consequence of the scattered nature of the accounts of the botany of the region west of the Mississippi, and the absence of any text-book in which correct descriptions could be found, to publish a complete list of the plants, with all the synonyms and species. For a working botanist, engaged in the study of our western plants, the search for what has been written takes more time and labor than all the rest of his work, besides which there is always the probability of overlooking some writings of importance. The design has not heretofore been carried out, on account of the pressure of other operations, but recently the great need of this aid to botanical research having been urged on the Institution by some of the principal botanists of the country, arrangements have been made with Mr. Sereno Watson, of New Haven, to prepare the work in question. The expense of preparation will be borne by private subscription, the Smithsonian Institution paying for the clerical labor and for the publication. Mr. Watson is esteemed highly competent for the duty intrusted to him, and is favorably known from his labors as botanist of the exploration of the fortieth parallel, under Clarence King, esq. Good progress has been made in the work, and during the year we expect the manuscript to be completed.

In still further pursuance of the plan initiated by the Institution of furnishing aids for the arrangement of collections, as illustrated by its series of check-lists of specimens, an article by Professor Theodore Gill is in process of publication, entitled "An Arrangement of the Families of Mollusks." His system has been adopted provisionally as that by which the extensive collections of the Smithsonian shells are to be arranged and has been approved by some of the principal zoölogists of the country. To extend its benefits, and furnish a similar guide to other museums, the list embraces families, recent and fossil, accepted by the best naturalists of the day, although embodying results of special investigations made by Professor Gill and Mr. Dall at the Institution.

The Annual Report for the year 1869 was printed as heretofore, by order of Congress, but there was a reduction of one thousand in the number of extra copies usually furnished to the Institution. This reduction must have been the result of inadvertence, as we have long urged upon Congress the great demand for the document as a reason

for the increase of the edition, and have been assured by many Senators and Representatives that this would be made. The applications for the report have become so numerous that it is impossible to supply all who are entitled to receive it. In this connection the propriety should be urged upon Congress of ordering new editions of such of the reports as have been stereotyped. The printing of these could be done at very little expense, and would enable the Institution to furnish volumes, for which there is daily application from members of Congress in behalf of libraries and public institutions, to complete sets of the series.

In addition to the report of the Secretary, giving an account of the operations, expenditures, and condition of the Institution for the year 1869, and the proceedings of the Board of Regents, it contains the following articles: Memoirs of Kepler, Thomas Young, Auguste Bravais, C. T. P. Von Martius, and Stefano Marianini; an original paper on the chemistry of the earth, by T. Sterry Hunt; articles on the electrical currents of the earth; phenomena of flight in the animal kingdom; the northern seas; report on the transactions of the Society of Physics and Natural History of Geneva; an original article relative to Coronado's march in search of the seven cities of Cibola, and a discussion of their probable location; social and religious condition of the lower races of man; principles and methods of palæontology; remarks on the Cara Gigantesca of Yucatan; forests and their climatic influence; meteorites; remarkable forms of hail-stones in Georgia; eruption of the volcano of Colima. It is proper to remark that the article on the flight of birds was translated from the French by Mr. W. H. Dall, whose name was accidentally omitted at the head of the article.

For the purpose of forming a general map of the North American Continent, exhibiting the plains, mountains, valleys, &c., the Smithsonian Institution has collected a large amount of material relative to *altitudes*, which has been placed in the hands of W. L. Nicholson, esq., topographer of the United States Post Office Department, to be discussed and elaborated.

There must, however, still remain in the hands of individuals and corporations records of an important character, which would be of great value in properly carrying out the enterprise. The correspondents of the Institution are requested to send to it printed copies or original manuscripts of records, especially of plotted profiles or maps, pertaining to this subject.

In stating the heights, as furnished by surveys for railroads, whether actually constructed or only projected, it is desirable that the levelings be referred to some known point on connecting or intersecting roads, or to the water-surface (high water, low water, or mean tide) of the ocean or of one of the great lakes, or to the level of a noted stage of water (high or low) of some river. The crossings of the water-courses, ridges, and summits are particularly desired, as well as all considerable and characteristic changes of level, giving, where much difference exists,

both grade-line and original surface; the levels of all intersections with other roads are important as means of comparison, and for checking results. Due credit will be given to all contributors to this work.

Exchanges.—The system of international exchanges, established by the Institution, has been continued with unabated zeal during the past year. The number of foreign establishments to which the Smithsonian and other publications are distributed, and from which returns are received now amounts to over seventeen hundred. It includes not only all the first-class libraries and societies which have established a reputation, but also a large proportion of the minor institutions of the Old World. The following table exhibits the number of foreign institutions in each country with which the Smithsonian Institution is at present in correspondence:

Sweden	19	Turkey	10
Norway	11	Africa	14
Iceland	2	Asia	30
Denmark	25	Australia	25
Russia	154	New Zealand	10
Holland	59	Polynesia	1
Germany	529	South America	31
Switzerland	54	West Indies	6
Belgium	119	Mexico	5
France	80	Central America	1
Italy	141	British America	27
Portugal	5	General	5
Spain	9		
Great Britain and Ireland	286		1,744
Greece	6		

During the year 1870, 1,805 packages, containing many thousand different articles, were transmitted to foreign countries. These packages were contained in 121 boxes, having a cubical content of 1,189 feet, and weighing 31,383 pounds. The parcels received at the Institution for parties in this country numbered 3,705. The separate volumes contained in these parcels would largely increase the number, the Institution having received 5,182 articles for its own library. The war between France and Germany, which commenced in July, affected, in some degree, the number of packages received from these countries, and it is probable that the result of this unfortunate conflict will be still more marked in the diminution of the number of scientific publications which may be received from Europe in the year 1871. The Smithsonian packages are passed through all the custom-houses of the world free of duty. The only exception which existed at the date of the last report was that of Italy, and through the intervention of the American minister, Hon. Mr. Marsh, the Italian government has since granted the same privilege.

As in previous years, the Institution has received great benefit from the privileges of free freight for its packages, accorded by a large number of steamboat and railroad lines of transportation. In this report, as in former ones, reference should be made to the liberality of the Pacific Mail Steamship Company; of the Panama Railroad Company; of the Pacific Steam Navigation Company; of the New York and Mexican Steamship Line; of the New York and Brazilian Line; of the North German Lloyds; of the Hamburg American Packet Company; of the French Transatlantic Company; of the Inman Line; and of the Cunard Line. I am happy to announce that to the foregoing list is to be added the Anchor Line of steamers between New York and Glasgow, of which Messrs. Henderson & Brother are the New York agents; and I would recommend that an official acknowledgment be made, on the part of the board, to these gentlemen for their courtesy in offering to the Institution the same privileges accorded by the other New York lines. The Union Pacific Railroad Company has granted free transportation, although thus far we have not been able to avail ourselves of the privilege. The Adams Express Company also continues its liberal policy in regard to our freight. It would be quite impossible for the Institution, without the aid thus liberally afforded, to carry out, in its full efficiency, its system of international exchanges, which, by facilitating the intercourse of scientific institutions and of students throughout the world, constitutes one of its most important features.

It is also my duty, as well as a great personal gratification, to inform you of the liberality of several of these companies, extended to myself on the occasion of the visit to Europe which I made during the past summer, in obedience to your authority; the agents of the North German Lloyds, Messrs. Schumaker & Co., of Baltimore, and Messrs. Oelrichs & Co., of New York, as well as Mr. C. G. Francklyn, the agent of the Cunard steamers, having offered me a free passage across the ocean.

Library.—As in previous years, large accessions have been made to the library of the Institution, principally through the system of international exchanges. The following is a statement of the number of books, maps, and charts received during 1870, most of which have been deposited in the National Library in accordance with the arrangement entered into several years ago, and fully explained in preceding reports:

Volumes:		
Octavo or less	842	
Quarto or larger	270	
		1,113
Parts of volumes:		
Octavo or less	1,263	
Quarto or larger	561	
		1,824

Pamphlets:		
Octavo or less	1,764	
Quarto or larger	302	
		2,066
Maps and charts		179
Total receipts		5,182

The following are some of the larger donations received in 1870:

From the ministry of the interior, Christiania, Norway, "Den Norske Lods;" 2 volumes, octavo, and 71 charts.

From the Imperial Botanical Garden, St. Petersburg, "Sertum Petropolitarum seu icones et descriptiones plantarum quæ in Horto Botanico Imperiali Petropolitano floruerent." Parts I and II, 1846; III and IV, 1869. Folio.

From His Majesty the King of Prussia, "Danzig und seine Bauwerke in malerischen Original-Radirungen mit geometrischen details und text, Von Johann Carl Schultz;" volumes I–III, oblong folio.

From Dr. Koch, Berlin, 127 pamphlets, University Theses.

From the Royal Public Library, Dresden, "Riedel's Codex Diplomaticus Brandenburgensis;" 41 volumes, quarto.

From the Agricultural Association, Potsdam, "Zeitschrift;" volumes III–XVIII, octavo. "Monatschrift," volumes XIX–XXIII, octavo; and "Amtliches Vereinsblatt," 1869, quarto.

From the Austrian government, "Reichs-Gesetz-Blatt für das Kaiser thum Oesterreich;" 1849–1869, quarto, 21 volumes.

From the Musée de Douai, "Dictionnaire des Sciences Médicales;" volumes I–LX, quarto.

From the minister of public instruction, Florence, 11 volumes "On Education, Public and Private."

From the minister of public works, Florence, 25 volumes and 16 pamphlets. Hydraulics, Navigation, and Engineering, &c.

From the meteorological office, London, "Daily Weather Reports," July 1, 1868, to June 30, 1870, (4 volumes and 6 parts,) folio; and "Quarterly Weather Report," part I.

From William Blackmore, esq., Liverpool, "Hoare's Ancient History of Wiltshire," volumes I and II, folio, beautifully illustrated with maps and plates. "The People of India: A series of photographic illustrations, with descriptive letter-press;" volumes I–IV, 1868, quarto. "Tree and Serpent Worship, or Illustrations of Mythology and Art in India in the First and Fourth Centuries after Christ;" quarto; and various other works.

From the State of Illinois, State documents, 14 volumes.

The incorporation of the library of the Institution with that of Congress continues to be productive of the results which were anticipated from this union. The extensive series of transactions of learned

societies, the number of sets and volumes of which are constantly increasing through the Smithsonian exchanges, is an important feature of the National Library, while the use of the books on special subjects belonging to the Government greatly enlarges the facilities for investigation of the collaborators of the Institution. From the first a harmonious co-operation has existed between the two establishments, and on all occasions we have found Mr. Spofford, the accomplished librarian of Congress, ready to consult the interests of the Institution, and insert on his list of purchases any work which we might indicate as desirable for scientific research. Professor Gill, formerly in charge of the Smithsonian library, and now one of the principal assistants in the Library of Congress, still continues his connection with the Institution, and in spending, as he does, most of the hours unemployed in official duty in scientific research at the Smithsonian building, affords the means of constant communication.

The National Library is rapidly increasing in value, both in regard to the number and the character of the books which are annually added to its collections. The sources of increase are, first, the books purchased by the liberal appropriation of Congress; second, the Smithsonian exchanges; and, third, the deposit of books in accordance with the copy-right law. From this last source it has lately received a very large addition of all the American works secured by copy-right since the first enactment of the copy-right law, and previously in charge of the Secretary of the Interior. These books exhibit the phases of thought and the progress of the mental activity of this country for nearly half a century, and have, therefore, a special value independent of their literary or scientific character.

At the time of the organization of the Smithsonian Institution, Congress directed that in order to secure the right of authorship of a book three copies of it should be deposited as evidence of title, one in the library of the Institution, another in that of Congress, and a third in the office of the United States district court. In the case of a costly work, perhaps in several volumes, this was a tax on the author or publisher for the protection of his property which was not improperly considered oppressive. From considerations of justice, therefore, as well as of a prudent regard to the cost of the care of these books, the Smithsonian Institution was the first to petition Congress that the law might be so modified that only two copies should be required to be deposited as evidence of title, and these in the Library of Congress. The proposition suggested in this petition was adopted, and I believe the law enacted in accordance with it now meets with general approbation. It is of some importance that this fact should be mentioned, because copies of books are still occasionally sent to the Institution from a want of a knowledge of the existing law.

Besides the general library of the Government in the Capitol each of the separate Departments, as well as several of the bureaus, has a spe-

cial library. When we add to these the Washington Library and that of the Young Men's Christian Association, the aggregate of the books in the city of Washington must be greater than that in any other city in the country in proportion to the population. Unfortunately, however, these collections are not at present as readily accessible to the public as could be desired. The rapid increase, however, of the National Library will soon render the erection of a separate building absolutely necessary, and in the new arrangement which will result from this, the different libraries can, perhaps, be brought into harmonious relation, and while provision is afforded for the accommodation of a much larger number of readers, the number of hours during which the books are accessible may be increased.

Explorations and collections.—The Institution has continued, during the past year, as heretofore, to prosecute researches and explorations in ethnology and natural history, both by detailing special agents for particular work, and by co-operating with private individuals and Government expeditions, in securing the desired result.

Among the more important of the first-mentioned class was an investigation among the mounds of Tennessee, under Mr. J. P. Stelle. This gentleman spent a number of months in examining carefully several groups of ancient mounds, and has furnished an interesting account of his researches, accompanied by topographical drawings of the localities, and large numbers of specimens, obtained in the course of his explorations. The report of Mr. Stelle will be printed in the appendix to the annual report of the Institution.

Professor Baird, during his visit to Wood's Hole, in Vineyard Sound, continued his investigations of previous years among the shell-heaps of the coast, and added largely to the collection in archæology. He also devoted much attention to the study of the habits of the marine fishes of that part of the coast. Under the special direction of Professor H. E. Webster, a system of dredging was carried on in the same locality, from which an interesting series of mollusca and other marine animals was procured.

Captain Dow, of the Panama Railroad service, has furnished important collections from Central America, among them the skulls of what will probably prove to be a new species of tapir. Mr. Durkee, of Wyoming Territory, has supplied a large number of specimens of nests and eggs, with fossils and other objects from his locality, embracing several species not before in the collection.

The largest collections, however, received during the year, are those made by Professor Hayden, as United States geologist for the Territories. These, in accordance with the law of Congress making the Institution the depository of all objects of nature and art, natural history, etc., belonging to the United States, have been sent from time to time to the Institution, forming an aggregate of about sixty boxes, and em

bracing large numbers of new species of fossil mammals, reptiles, and fishes, with other interesting objects.

Mr. R. McFarlane, Mr. James Lockhart, and Mr. Strachan Jones, who have been extremely liberal to the Institution in previous years, have again made important additions to its store of specimens, illustrative of the natural history of the region of the far northwest.

In accordance with the understanding between the Institution and the Medical Department of the Government, the specimens of human crania obtained by us have been transferred to the Army Medical Museum, which has, in turn, sent to the Institution all other articles it had received in ethnology and archæology. By this means a very extensive and valuable series of specimens has been obtained by the Institution during the past year. A full list of the additions thus made, will be found in the appendix to the present report.

Another collection worthy of special mention was presented to the Institution by the Colonial Museum, at Wellington, New Zealand. This consisted of bones of the *Dinornis*, the skins and skeleton of the *Apteryx*, skins of other birds, shells, and ethnological specimens of the country, and was partly in return for a valuable series of books presented by the Institution to the colonial government.

The labors of Dr. Edw. Palmer, already well known in connection with the ethnological museum of the Institution, have been continued during the present year, and large numbers of articles of Indian manufacture, both ancient and modern, attest his zeal and success as a collector. A more detailed report will be made upon these when the entire collection is received. Lieutenant Ring, of the Army, has continued his valuable donations from Alaska, embracing specimens of animals as well as Indian relics of great antiquity. From Captain C. M. Scammon, of the United States revenue marine, we have received a number of specimens and several important communications in reference to the seals and whales of the Pacific coast. A memoir submitted by this gentleman to the Institution has been published by the Philadelphia Academy of Natural Sciences, and is considered an important contribution to the knowledge of the subject already existing. Dr. G. M. Sternberg and his brother, Mr. C. H. Sternberg, have transmitted extensive and valuable collections of the tertiary fossil plants of Kansas, and other objects of interest. The former have been found, on examination by Mr. Meek, to contain a number of new species, which will shortly be described.

It will be remembered that an exploration of the Isthmus of Tehuantepec, by Professor Sumichrast, has been in progress for some years past, under the direction of the Institution, the expense of which was defrayed in part by the Kentucky University at Lexington, by the Boston Society of Natural History, and by the Academy of Natural Sciences of Philadelphia. The labors of Professor Sumichrast were brought to a close during the past summer, and several of the collaborators of the Institution are now at work in investigating particular

branches of the collection with a view to prepare reports on them. The birds of the collection are in charge of George N. Lawrence; the insects, of Mr. Scudder; the shells, of Mr. Bland; and the reptiles and fish, of Mr. Cope. The series is very complete, and is believed to express essentially the zoölogical character of an interesting portion of Mexico. As specially noteworthy in this connection, is the donation by the Imperial Zoölogical Museum of Vienna, of the skin and skeleton of the European aurochs. This animal, according to Professor Baird, is a species of bison, and very closely related to the American buffalo, if, indeed, it be not, as some naturalists assert, the same. It was formerly found in abundance in Europe, and is mentioned by Cæsar, Tacitus, and other classical writers. It has been almost entirely exterminated, existing at the present time only to the number of a few head in Lithuania and in the Caucasus. The European specimens are preserved with jealous care by the Russian authorities, and severe penalties are imposed for killing or even injuring them.

The number of donations to the collection of the Institution received during the past year is so large that we find it impossible at this time to give to each that special mention which it deserves. A list of them, however, with the names of the donors, will be found in the appendix to the present report; and I embrace this opportunity to express the thanks of the Institution to all who have thus aided in furthering its objects, and to invite their kind co-operation for the future.

The usual statistics in regard to the number of specimens catalogued during the year, and the extent to which the distribution of duplicates has been made, will be found in the accompanying tables. It will be seen that the average of the past years has been fully maintained, and that as far as the material and force at the command of the Institution would permit, the work has been faithfully carried on.

The museum.—Congress having made an appropriation for the better display of the specimens belonging to the Government, it becomes a matter of importance to carefully consider the character which is to be given to the national museum. There is scarcely any subject connected with science and education to which more attention is given at the present day than that of collections of objects of nature and art, known under the general denomination of museums. This arises from their growing importance as aids to scientific investigation and instruction. As they are intended to subserve different ends they are of different characters. There are, on the one hand, large central museums supported by Government appropriations, and on the other, local museums which are established and sustained by societies and voluntary individual aid. The latter are established in almost all parts of the Old World, and are becoming somewhat numerous in this country. The special aim of the directors of these should be to make full collections of all the objects of natural history in their vicinity, not only for the instruction of

the members of the society, and to diffuse a taste for the refined, intellectual pleasure, which is derived from the minute observation of the natural world, but also to furnish lists of local floras and faunas, and of mineralogical and geological localities which may serve to establish the area of distribution of special objects of nature, and thus contribute to the extension as well as the diffusion of knowledge. The directors of museums of this character ought to be careful not to attempt to form general collections, other, perhaps, than a limited number of specimens for comparison, since it will soon be found that the cost and labor of the proper care and exhibition of the local collections will equal the means which can be commanded for this purpose.

Large museums or collections supported by Government appropriations are of different characters, in accordance with the objects they are designed to subserve. They may be intended exclusively for scientific research, and for this purpose consist of large numbers of specimens and duplicates, as it were, of the raw materials of science, which have never been investigated, but which may serve for the study, of the productions of entirely unexplored regions. It has been the policy of this Institution to make collections of this kind, to submit them to experts for critical examination, and to publish such descriptions as would render them subservient to the progress of scientific generalization. If these descriptions were exhaustive, the original specimens would no longer be required for further scientific investigation; but, unfortunately, the characteristics and peculiarities of the specimens are only partially recognized and represented at any one period, and hence it becomes necessary from time to time to go over the same ground in order to verify or disprove new and ingenious suggestions as to peculiarities and relations not hitherto recognized; the specimens must therefore be preserved, especially if they are of such a character as cannot readily be replaced. In making such collections the Smithsonian Institution has done, perhaps, more than any other establishment during the twenty-four years of its existence. It might, however, have effected much more good and extended its influence more widely if all the duplicate specimens had been made up into sets and distributed soon after they were collected. But this was impossible with the limited means at the command of the Institution and the assistance it could obtain from voluntary unpaid collaborators. Besides this, some advantages have resulted to science from the retention in the Institution of a large number of every variety of a class of specimens. This has enabled the naturalist to make comparisons which would have been otherwise impossible, to mark peculiarities connected with age, sex, food, climate, etc., and to observe the diversities of form and structure due to the varying conditions of life. As an illustration of this remark we may refer to the results which Professor Baird has been enabled to arrive at from the unrivalled opportunity which he has had in the extensive collection of the Institution, of

studying the relations of nearly sixty thousand specimens of the birds of North America.

The object of the collection we have just described is exclusively the advance of science. The specimens require comparatively but little space for use and preservation. Not being intended for public exhibition they need not be mounted, but may be kept in drawers, or packed away in labeled boxes or casks until wanted for a special investigation.

Another class of large museums are of a mixed character, combining in their object scientific investigation with special systematic and collegiate instruction. Of this class is the great museum at Cambridge, supported principally by the State of Massachusetts, and under the direction of Professor Agassiz. This museum, which may be considered a model of its class, embraces—first, an immense number of original specimens, in the study and description of which a number of accomplished naturalists are continuously employed; second, a series of specimens which have been scientifically described, and so arranged in accordance with their affinities as to enable the student in any branch of natural history to obtain, with the least expenditure of labor, a definite knowledge of what is known of the objects to which he is devoting his attention; third, a series of specimens of genera so arranged as to serve as illustrations of the courses of lectures to the students of the university on such general principles of natural history as form an essential part of a liberal education. This museum, therefore, affords ample means for the advancement of science by original investigation; for the special training of students who desire to devote themselves to natural history, and for collegiate instruction, while the facilities which it is calculated to afford in these lines are only limited by the funds which it can command.

Another class of museums supported at the public expense are those intended almost exclusively for popular instruction and amusement. Museums of this class have been established in several of the principal cities of Great Britain, and I doubt not that the beneficial effects they are producing will induce other cities to follow their example. The most important of these is the one at Liverpool, in which series of generic specimens are admirably mounted and so arranged as to clearly exhibit their relations and affinities. They are, moreover, all distinctly labeled, so that the visitor, almost without an effort, receives definite impressions, valuable in themselves, and which, by association of ideas, become more important as centers around which other ideas, derived from future reading and observation, may be clustered. The impressions made through the eye are not only the most definite, but also the most indelible. Museums of this kind ought to be established at the public expense in every city or community which can afford the means for their support. So popular are collections of objects of natural history and ethnology, that large establishments of mere heterogeneous materials are frequently sources of profit to those to whom they belong.

In some cases, in a better class of museums, a small admission fee is demanded, and the whole proceeds of this expended in sustaining and enlarging the collections. As an example of this I may mention the public museum established by Mr. Woodward in San Francisco, which is not only a source of continued amusement to the inhabitants of that city, but also a means of adult education, since the specimens are generally well classified and properly labeled. Advantage should be taken through museums, of a feature of the human mind essential to progress, the desire for novelty, to lead the public to the employment of the intellectual pleasure derived from the study and contemplation of nature. It is truly surprising how tastes may be formed, how objects before disregarded may, when viewed as a part of a natural family, be invested with attractions which shall ever after render them sources of refined pleasure and unalloyed enjoyment.

While the Smithsonian Institution should continue to devote a portion of its own funds to assist in explorations which have for their object the advance of science, the public museum, with the care of which it is intrusted by Congress, should, in my opinion, without detracting from its scientific character, largely partake of the popular element. It is to be supported by the Treasury of the United States, and should, therefore, be an object of interest to the large number of visitors who are annually drawn to Washington by curiosity or otherwise, and who cherish a patriotic pride in whatever redounds to the reputation of the national capital.

Besides specimens properly labeled for study, especially of the continent of North America, it should contain those to fully illustrate in part, at least, the more prominent divisions of the animal, vegetable, and mineral kingdoms. These should be so arranged, regard being had to artistic effect, as to exhibit the principles of classification, the relation of organs to one another and to those of their allies, the phases of their organization, and other peculiarities relating to their habits and places in the economy of nature. To assist in this, models and pictorial illustrations of magnified smaller parts and of minute structures should be supplied. In every instance the objects should be accompanied with copious legible descriptions, and in no case should a group contain a single specimen more than is absolutely necessary for the general purpose. Economy of space in a public museum should never be consulted at the expense of clearness of illustration. The national museum should contain skeletons in the original, or casts in plaster, of all the larger fossil animals—sections and scenic representations on a large scale of geological periods, and modeled figures of the different races of men and species of animals.

The space which is at present available in the Smithsonian building for a general public museum consists of the following apartments:

1. On the first floor a room 200 feet long and 50 feet wide. 2. Another large room, in the west wing, 65½ feet long by 35 feet wide, with a

semi-circular projection at one end. 3. A connecting range of 60 feet long by 37 wide. 4. In the second story a single large room of 200 feet long and 50 feet wide. The large room on the first floor is not well adapted to the display of specimens, since it is occupied through its whole length with two rows of colossal columns. The upper room, however, as well as that in the west wing of the building, is entirely free from all hindrance to an arrangement with a view to the best exhibition of the collections. I have said that the rooms above mentioned constitute the present available space for the accommodation of the museum. When, however, more space is required, the eastern wing, now in part occupied as a residence by the Secretary, can be employed for the purpose. The floor and partitions which separate the several apartments of this portion of the building are of a temporary character and can be readily removed. The lower part of this wing and its basement are now used for containing the exchanges and as store-rooms for duplicate specimens of geology and mineralogy. In accordance with the views which have been presented, it is intended to devote the whole of the large room in the second story of the main building to archæological objects with skeletons, life-size drawings, and restorations of the larger mammals contemporary with primitive man, especially on the continent of America. Second, to appropriate the wall-surface and a part of the floor-space of the western wing of the building to mineralogy and geology. The portions of the extensive walls of this room can be covered on the east side, which presents an unbroken surface above the top of the cases of 65 feet by 10 feet, with a geological section across the continent, and the opposite wall with drawings of the characteristic fossils of the strata which are exhibited on the eastern wall. The side and mineral cases for containing the specimens, besides exhibiting a characteristic series of specimens, to represent general geology, mineralogy, and palæontology, will be occupied with full sets of specimens to illustrate the geological formation of North America, and especially the mineralogical resources of this country.

The collection of objects to illustrate anthropology now in possession of the Institution is almost unsurpassed, especially in those which relate to the present Indians and the more ancient inhabitants of the American continent. An artistic and scientific exhibition of these in the large room we have mentioned, could not fail to be highly interesting to the general public, the student of ethnology, and especially to the many intelligent foreigners who visit the capital of the United States. There are also in the collection of specimens in charge of the Institution full sets of all the rocks and minerals collected by the several exploring expeditions which have been sent out by the General Government, besides those which have been presented as free gifts or in exchange to the Institution from all parts of our continent. We can, therefore, with scarcely any additional material, or only with such as can be readily obtained, render the national museum much more

creditable to the Government and the Institution than it has ever yet been. Such a collection will tend to draw to itself numerous isolated collections, especially of anthropology, which, though they may be of much interest to the individuals possessing them, are of comparatively little value in the way of advancing a knowledge of the subject to which they pertain, and, in case of the death of the owners, are generally dissipated and frequently lost to the world. The only way in which they can become of real importance is by making them part of a general collection, carefully preserved in some public institution, where they can be studied and compared with other specimens, and where, in the course of the increasing light of science, they may be made to reveal truths beyond present anticipation.

Herbarium.—An account of the transfer of the extensive collection of plants of the Institution to the care of the Department of Agriculture has been given in previous reports, but it is thought important to place on record a more detailed history of this collection than has yet been published, and I therefore present the following account of it from notes furnished by Dr. Torrey.

The Institution having accumulated a large number of botanical specimens collected in various parts of the world, most of them brought home by the Government exploring expeditions, others presented by authors of botanical works, travelers or special collectors, the offer was made by Professor John Torrey to arrange, without compensation, all these separate collections into one general herbarium. This offer was gladly accepted on the part of the Institution, and all the specimens on hand, and all that were subsequently received up to 1869, were transferred to him. When he commenced the task, the specimens, especially those collected by the Institution, were still in bundles as they were received, and all required to be poisoned to prevent their destruction by insects, which had already commenced their ravages. The plan adopted by Dr. Torrey for the arrangement of the plants was of the most approved character. Each species, often represented by several specimens, and all the marked varieties, are fastened to a half sheet of strong white paper and labeled. All the species of a *genus* are laid on one or more whole sheets of thicker tinted paper, on the lower left-hand corner of which the generic name is written. The genera are arranged according to the natural system, following for the most part the order of De Candolle. A very large proportion of the specimens are authentically named by the authors who have described them; and as they are the type-specimens or originals of several important works are invaluable for reference. Some of the more valuable portions of the Smithsonian herbarium are the following:

1. The plants collected by the exploring expedition under the command of Admiral Wilkes, during the years 1838 to 1842. Many countries were visited in this voyage round the world, and an extensive herbarium

brought home. The botanists of the expedition were Mr. William Rich, Dr. Charles Pickering, and Mr. W. I. D. Brackenridge. To the last-named gentleman was assigned the description of the ferns, his report on which was printed by order of Congress in a handsome quarto volume, with a folio atlas, containing beautifully engraved figures of the new or little-known species. After a very few copies of this work were distributed, the remainder of the edition was destroyed by fire while in the hands of the binder. The copper-plates, however, are still in the custody of the Library Committee of Congress, and it would cost but little to print a new edition of a work so much desired by a large number of botanists. The flowering plants, with the exception of those collected in California and Oregon, were referred to Dr. Torrey; others were partially studied by Mr. Rich, and then committed to Professor Asa Gray for a more thorough investigation. Of this portion of the collection only one quarto volume of text, and a large folio volume of illustrations, have thus far been published by Congress. For a number of years the publication of the works relating to the exploring expedition was in charge of the Joint Library Committee of Congress and Admiral Wilkes, but it was impossible to procure appropriations to defray the large expense of the undertaking. At length all the materials were transferred to the Smithsonian Institution, provided it would publish for distribution an edition of the whole. The limited income of the Smithsonian fund did not permit the Institution to embark in so formidable an undertaking, and plates, manuscripts, and printed matter are still in possession of the Committee on the Library of Congress.

Professor Gray is ready to go on with his work as soon as provision is made for its publication. Dr. Torrey's report has been long since completed, and the illustrations drawn, engraved, and even printed. At this late day, however, the report would require revision; indeed, so many new and rare species described in it have since been found and described by other botanists, that it may be sufficient to publish a very brief report, accompanied by the plates alluded to above. The *Mosses* were described and beautifully illustrated by W. S. Sullivant, esq., of Columbus, Ohio. The text in quarto of his valuable report is also printed, but not published. He has, however, at his own expense, printed for private distribution a beautiful edition of it in folio. The *Algæ* were committed to Professor J. W. Bailey, of West Point, and Professor W. H. Harvey, of Trinity College, Dublin, whose report on these plants, with elaborate illustrations, is printed, and has been, for years, stored away in sheets awaiting to be bound up and published with Dr. Torrey's report. The same may be said of Professor Tuckerman's account of the *Lichens*, and of the reports by Rev. M. A. Curtis, of North Carolina, and Rev. Dr. Berkely, of England, on the *Fungi*.

2. The next most extensive and valuable portion of the herbarium is the collection of plants made during the North Pacific exploring expedition, under command of Commanders Ringgold and Rodgers, from 1853

to 1856, by Mr. Charles Wright, an accomplished botanist, who accompanied the Mexican boundary commissioners in their surveys, and who has also made extensive botanical explorations in Cuba. There has been no full report of the collections made on the North Pacific expedition, though many of the new species have been published by Dr. Gray.

3. The naturalists who accompanied most of the surveying parties which made explorations for the route of a Pacific Railroad collected large numbers of plants, many of which were new to the botanist, and have been described in the published reports of these explorations.

4. Collections made in the Mexican boundary survey by Dr. C. C. Parry, Dr. J. M. Bigelow, Mr. C. Wright, Professor George Thurber, and Mr. Arthur Schott, are among the most extensive and valuable portions of the herbarium. A full account of them, by Drs. Gray, Engelmann, and Torrey, is contained in General Emory's report. The Cactaceæ, and one or two smaller orders, were described by Dr. Engelmann; the Compositæ, Scrophulariaceæ, and one or two other orders, by Dr. Gray; and the ferns, with their allies, by Professor D. C. Eaton. The remaining Cryptogamia are not included in the report, but most of the new or rare ones have been published elsewhere. The grasses were to be described in a separate memoir by Professor Thurber.

5. Large additions have been made to the North American portion of the herbarium, chiefly from within the limits of the United States and Territories, by contributions from the following places: New England, by Mr. Oakes, Dr. Gray, Professor Tuckerman, S. T. Olney, esq., Professor D. C. Eaton, and others; New Jersey, by Mr. C. F. Austin, Professor Eaton, Dr. Torrey, and Dr. Knieskern; New York, Messrs. Austin, LeRoy, Clinton, Torrey, and many others; Pennsylvania, by Dr. Darlington, and Professor Thos. C. Porter; North Carolina, by Rev. Dr. Curtis; Florida, by Dr. Chapman, (type-specimens of his flora of the Southern States;) Alabama, by Professor Winchell; Kentucky, Dr. Short, and Mr. Sullivant; Texas and New Mexico, Messrs. Fendler, Ervendberg, and others, besides what the botanists collected in the Mexican boundary survey; Rocky Mountains, Dr. Parry, Captain Macomb, and Dr. Newberry; Oregon, Mr. Geo. Gibbs, and others; Nebraska, Dr. Hayden; Nevada, Mr. Stretch; California, Dr. H. M. Bolander, General Frémont, Miss Davies, Th. Bridges, Mr. E. Samuels, Dr. Torrey, and many others; Colorado, Dr. Anderson, Frémont, and others. Besides these principal sources of United States plants, very many specimens have been received from other places and persons, which we have not space to enumerate. From British America, especially the sub-arctic portions, Dr. Kennicott, and officers of the Hudson's Bay Company have furnished specimens. Of foreign plants, besides those collected in the two United States exploring expeditions already noticed, the herbarium contains valuable and large contributions from Japan, Mantchuria, China, etc., from Professors Reïgel and Maximovitch, of the Imperial Academy of Science of St. Petersburg, and the Imperial Botanic Garden: A

large collection of Sandwich Island plants, (all type-specimens,) made by Mr. Horace Mann, lately deceased: A collection of plants from Mirador, Mexico, by Dr. Sartorius: Many specimens, with fleshy fruits in alcohol, collected on the Panama Railroad, by the late Dr. Sutton Hayes; others from the same region by Fendler, in 1850: Plants from Jamaica, especially ferns from Mr. Wilson; from Cuba, collected by Mr. Chas. Wright; Venezuela, many beautifully dried ferns by Fendler; from Texas and Northern Mexico, by Berlandier; Lower California, by Mr. Xantus; Brazil and Paraguay, by unknown collector. From Europe, there is an extensive collection of Hungarian plants from Mr. Arthur Schott, and of Illyrian plants from Professor Thomasini, besides many smaller collections from various parts of the continent. Dr. Torrey has contributed a large number of specimens from his own herbarium.

As to the disposition made of the duplicates of the collections, they have been sent in the name of the Smithsonian Institution to learned societies, botanic gardens, and individuals, whenever they could be disposed of for the advance of science. Full sets of duplicates were presented to the Royal Garden at Kew, near London, the botanic gardens of Paris and St. Petersburg, besides smaller portions to individuals, lyceums of natural history, and colleges.

This collection of plants has been transferred to the Agricultural Department, on the conditions set forth in the following documents, of which the originals are in the archives of the Institution and of the Agricultural Department:

WASHINGTON, D. C., *January* 1, 1868.

In order to the harmonious co-operation of the Smithsonian Institution and the Department of Agriculture in their respective provinces of advancing science, they enter into the following agreement relative to the disposition of specimens:

First. All the botanical specimens in possession of the Smithsonian Institution, about twenty thousand, and all that may hereafter be collected by it, shall be transferred to the Agricultural Department on the following terms:

1. That a competent botanist, approved by the Institution, shall be appointed to have charge of the collection.

2. That the collection shall, at all times, be accessible to the public for educational purposes, and to the Institution for scientific investigation, or for supplying any information in regard to plants that its correspondents may ask for.

3. That due credit be given to the Institution in the report of the Agricultural Department for the original deposit, and for such additions as may be made to it, from time to time, by the Institution.

Second. That the Agricultural Department shall transfer to the Smithsonian Institution any specimens it may now have, or may hereafter obtain, that are not necessary to illustrate agricultural economy; such as

those of ethnology and of various branches of natural history. Similar credit to be given in this case as is required in the former.

HORACE CAPRON,
Commissioner of Agriculture.
JOSEPH HENRY,
Secretary of the Smithsonian Institution.

The following is an account of the more important additions which have been made to the collection in the Agricultural Department by the Institution since the transfer of the general herbarium in 1868:

1. A set of European plants, numbering about four hundred species, presented by Professor Paul Reintz, of Germany, in exchange, at his request, for specimens of American plants.

2. A second very extensive collection of plants from the Imperial Academy of St. Petersburg, in return for donations from the Institution. This present, like all of those we have received from the Imperial Academy, is of a most valuable character. It consists of eleven hundred species from Russia, Siberia, Western Europe, and Japan.

3. Another large collection is from the widow of the late Mr. James McMinn, Williamsport, Pennsylvania, principally of plants from the mountainous regions of Pennsylvania, but also comprising specimens from other parts of this country and different localities in Europe. Mr. McMinn was a civil engineer, and in the practice of his profession in surveying lines for railways and canals became interested in the variety of plants which were presented to his notice, and as a means of recreation, as well as of intellectual improvement, commenced the study of botany. It would appear from the examination of his herbarium, that he had entered into extensive correspondence with some of the principal botanists of this country and Europe, and had enriched his collection by exchanges. His herbarium contained about five thousand species, among which is an interesting series of plants from the Alps. The special thanks of the Institution are due to Mrs. McMinn for the judicious disposition she has made of the results of the labors of her lamented husband, which we trust will be preserved among the collections of the Government, as a permanent memorial of his devotion to science and of her enlightened liberality.

Besides the foregoing there have been added several hundred bottles of samples of agricultural materials and products, numerous specimens of seeds, roots, fibers, fungi, sections of wood, &c.

Work done in connection with the collections.—Professor Baird, during the past year, in addition to his services in regard to the exchanges, natural history, and assistance in correspondence, has completed the systematic description of the land birds of the Pacific States, forming the first volume of ornithology published, in connection with its geological survey, by the State of California. The materials for this work

were from the manuscript notes of Dr. J. G. Cooper, of San Francisco, while the descriptions are principally from specimens in the Smithsonian collections. This volume, in regard to its typography, illustrations, and the character of its contents, does honor to the liberality of the State at whose expense it was published, as well as to the science of the country. Professor Baird has also continued his labors with Dr. Brewer, of Boston, on a work relative to the general ornithology of North America; in this he has been assisted by Mr. Robert Ridgeway, the zoölogist of the exploration of the fortieth parallel under Clarence King. To the latter, free access has also been given, in the preparation of his report on the birds of Mr. King's survey, to all the ornithological specimens in the Smithsonian collections.

Mr. Meek, the palæontologist, has made a preliminary report on the fossils collected by Dr. Hayden in his survey of Wyoming and contiguous Territories, and prepared lists of the same, with descriptions of the new species. He has described and prepared drawings of a collection of cretaceous fossils, sent by Professor Mudge to the Institution, from Kansas. He has made, besides several preliminary examinations, a final report on the fossils collected by Mr. King in the survey of the fortieth parallel, with full descriptions and illustrations of all the new species. He has also investigated the invertebrate fossils collected by the geological survey of Ohio, and prepared descriptions of the new species for publication; made a preliminary report, with descriptions of some new species, on a collection of carboniferous fossils sent by Professor Stevenson from West Virginia; continued his work on the illustrations of the monograph of the palæontology of the Upper Missouri. He has also identified collections of fossils, received from time to time at the Smithsonian Institution from collectors in various parts of the country.

Mr. Dall has been engaged in collating the extensive collection of manuscript notes of the Hudson's Bay and other Arctic American collaborators with whom the institution has been in correspondence for more than fifteen years. The part of these notes which he has finished relates to ornithology, and comprises many thousand items descriptive of the habits, distribution, and numbers of the birds of the regions above referred to. These will be used by Professor Baird and Dr. Brewer in their work on the birds of North America. The manuscripts also contain notes relative to the mammals and other animals, as well as to the ethnology of the same regions. When all these are collated and published they will form an interesting contribution to existing knowledge of the natural productions and ethnology of the North American continent.

Mr. Dall has also devoted considerable time to original investigations relative to the minute anatomy of the mollusca from specimens in the collections of the Institution. His principal labor, however, has been in the rearrangement of the very large series of shells from the west coast of America and of the North Pacific, including many types of the new

species of Gould, Carpenter, Cooper, Stearns, Pease, H. and A. Adams, &c. These have mostly passed through the hands of Dr. P. P. Carpenter, of Montreal, but still required to be placed in suitable trays, and provided with new labels and specially arranged for cabinet purposes. He has also had charge throughout most of the year of the record of additions to the museum, and the labeling of collections, especially those of ethnology and osteology.

Meteorology.—The system of meteorology of the Institution has been kept up as usual during the past year. The number of observers reporting to the Institution during this period is 515, and to the Medical Department of the United States Army, to the records of which we have free access, 140. The value of these observations increases with the number of observers and the time for which the several series are continued. But observations, however long-continued and extensive, are comparatively of little value unless they are reduced and discussed; and these operations can only be performed at the expense of great labor, since thousands of figures have to be tabulated and subjected to various arithmetical processes in order to deduce the general results which constitute approximate scientific principles. As we have stated in previous reports, the discussion of the rain and temperature has been for some years in charge of Mr. Charles A. Schott. The results in regard to the rain have been printed, and will form a part of the Smithsonian Contributions for the year 1871. A general account of these results was given in the last report, but in this it may be further stated that the principal deductions are made from an original series of tables giving the monthly rain-fall from the earliest periods from all sources in the United States and adjacent countries down to 1867. From these general tables a series of consolidated tables of means for seasons and years, for the whole time, is deduced. It was thought advisable, on account of the great expense, to publish for the present the consolidated tables, and to retain the others for reference or to answer special inquiries in regard to the rain-fall of particular stations. The former have been kept up to date, all the new materials having been incorporated; and to extend the system a large number of rain-gauges have been distributed to different parts of the country, and especially to the western States.

The temperature records are still under investigation by Mr. Schott. The work was in part temporarily suspended during his absence in Europe as a member of the expedition for observing the total eclipse of last December. The following is a statement of the present condition of the discussion.

The collection of material has for the most part been completed down to the present time, and tables of hourly, bi-hourly, and semi-hourly observations of temperature have been prepared. From these have been deduced tables to be used for the correction of daily variations of temperature. The daily fluctuation of the atmospheric temperature

has been discussed, and tables giving the times of sunrise and sunset for stations between latitudes 23° and 60°, to be used for corrections of daily variation, have been computed. The annual fluctuations of temperature have been in part discussed, and the tables of maxima and minima are in an advanced state toward completion.

All the observations relative to the winds, made under the direction of the Institution, and under the Medical Department of the Army, and all those which have been collected from other sources, have been placed in charge of Professor J. H. Coffin, of Lafayette College, for reduction and discussion. It was first intended to limit the investigation to the winds of North America, but it has since been considered advisable to incorporate the whole in a memoir on the general direction of the winds of the globe. To defray the cost of the extra labor, other than that of Professor Coffin, in this investigation, an appropriation has been made from the income of the Institution. During the year, Professor Coffin has been pressing on this work, with a number of assistants, as rapidly as the means at his command and his time would allow.

The Smithsonian meteorological system was commenced in 1849, and has continued in operation until the present time. Its efforts have been directed in the line of supplementing and harmonizing other systems, of a more limited character, with that of the more general one of the Army of the United States, and in some measure with the system established in Canada. It has done good service to the cause of meteorology, 1, in inaugurating the system which has been in operation upward of twenty years; 2, in the introduction of improved instruments after discussion and experiments; 3, in preparing and publishing at its expense an extensive series of meteorological tables; 4, in reducing and discussing the meteorological material which could be obtained from all the records from the first settlement of the country till within a few years; 5, in being the first to show the practicability of telegraphic weather signals; 6, in publishing records and discussions made at its own expense, of the Arctic expeditions of Kane, Hayes, and McClintock; 7, in discussing and publishing a number of series of special records embracing periods of from twenty to fifty years in different sections of the United States, of great interest in determining secular changes of the climate; 8, in the publication of a series of memoirs on various meteorological phenomena, embracing observations and discussions of storms, tornadoes, meteors, auroras, &c.; 9, in a diffusion of a knowledge of meteorology through its extensive unpublished correspondence and its printed circulars. It has done all in this line which its limited means would permit, and has urged upon Congress the establishment, with adequate appropriation of funds, of a meteorological department under one comprehensive plan, in which the records should be sent to a central depot for reduction, discussion, and final publication.

An important step has been made toward this desirable object in the

establishment, during the last year, by Congress, of a system of practical weather reports under the direction of the War Department, with ample means for the purchase standard instruments, the pay of assistants, and telegraphic dispatches. The results of this system in the way of prediction have been eminently successful, and have everywhere met with popular favor. The organization and administration of the system by General Myer, the director, has evinced great executive ability, and his wisdom has been shown in selecting Professor Abbe as his scientific assistant. It should be recollected, however, that the principles employed in foretelling the weather are practical results previously arrived at by the investigations of men of abstract science founded on simultaneous records without the aid of telegraphic communication. For the discovery of the general laws of meteorological phenomena, simultaneous observations should be made over large portions of the earth, and the records of these collected at stated periods, say at the end of every month, at some central office, and submitted first to preliminary reduction, and finally to the critical study of men like Espy, Redfield, and others, fitted by education, experience, and mental peculiarities to deduce from them the required generalizations. I would therefore suggest that a still larger appropriation be made by Congress to the War Department for establishing, besides the reports for weather signals, a series of intermediate stations, also furnished with compared instruments, to record daily observations to be transmitted to Washington weekly or monthly, and also that provision be made for the support of a number of competent persons to carry on the reductions and prepare the results for publication.

It has been the policy of this Institution from the first to do nothing which can be done as well or better by other means, and in accordance with this policy the Institution would willingly relinquish the field of meteorology, which it has so long endeavored, though imperfectly, to cultivate, turning over to the Signal Office all the material which it has accumulated up to a given epoch. We would advise also a similar course to be pursued on the part of the Medical Department of the Army. All the deductions from the combined materials which have been collected up to the present time should be obtained and published, although since, they may be in many respects defective, they contain the essential element of long periods of meteorological changes and a new era commence with more precise instruments and improved methods of observation. From such a system, however perfect it may be, immediate results are not to be expected. New and important deductions can scarcely be obtained until after a continuance of the system for several years, as, for example, the accurate determination of the periodicity which probably exists in regard to the droughts of the western coast.

Before closing this report it is proper that I should refer to a resolution adopted by your honorable board at its last session, granting me leave of absence to visit Europe to confer with savans and societies relative to the Institution, and making provision for the payment of my expenses. The presentation of this proposition was entirely without my knowledge, but I need scarcely say that its unanimous adoption was highly gratifying to my feelings, and that I availed myself of the privilege it offered with a grateful appreciation of the kindness intended.

I sailed from New York on the 1st of June, returning, after an absence of four and a half months, much improved in health and with impressions, as to science and education in the Old World, which may be of value in directing the affairs of the Institution. Although limited as to time, and my plans interfered with somewhat by the war, I visited England, Ireland, Scotland, Belgium, parts of Germany and France. But deferring, for the present, an account of my travels and the observations connected with them, I will merely state that, as your representative, I was everywhere kindly received, and highly gratified with the commendations bestowed on the character and operations of the Institution intrusted to your care.

Respectfully submitted.

JOSEPH HENRY.

JANUARY, 1871.

REPORT

OF

PROFESSOR JOSEPH HENRY,

SECRETARY OF THE SMITHSONIAN INSTITUTION,

FOR THE YEAR 1871.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1872.

REPORT

OF

PROFESSOR JOSEPH HENRY,

SECRETARY OF THE SMITHSONIAN INSTITUTION,

FOR 1871.

To the Board of Regents of the Smithsonian Institution:

GENTLEMEN: I have the honor to present herewith another annual report, in which I am happy to inform you that the financial affairs of the Institution intrusted to your care by the Government of the United States are still in a favorable condition, and that its operations during the year 1871 have continued to enlarge the bounds of human knowledge and to facilitate the international exchange of scientific truths.

Finances.—The following is a general statement of the condition of the Smithson fund at the beginning of the year 1872, as will be seen by a reference to the report of the Executive Committee:

Total permanent Smithson fund in United States Treasury	$650,000 00
In addition to the above there remains of the extra fund, derived from savings, &c., in Virginia bonds, at par value, $88,125.20; now worth about	35,500 00
Cash balance in First National Bank	16,315 02
Amount of congressional appropriation for the fiscal year, June 30, 1872, $10,000, one-half of which is available January, 1872	5,000 00
Total Smithson funds, January, 1872	706,815 02

The Virginia stock, which in 1870 was $72,760, has been nominally increased to $88,125.18 by the funding of the interest due, while the marketable value of the whole has declined from $48,000 to $35,500. This fall in the value of the Virginia stock has been due to the unsettled policy of the State in regard to its public debt. It will be recollected that all the other State stocks held by the Institution, in which the savings from the income had been invested, were sold in 1867, and the proceeds, added, by an act of Congress, to the permanent fund, forever deposited in the Treasury of the United States. The Virginia stock was retained, with the confident expectation on the part of the majority of the Board of Regents that its value would increase. Not the slightest idea was entertained that Virginia, with

all her resources and a large amount of money in her treasury, would hesitate to make provision for the payment of the interest on her bonds. It is still confidently expected, from recent indications, that the value of this stock will increase. I would, however, recommend that it be disposed of as soon as may be, and the proceeds added to the permanent fund.

In an institution of this kind no dependence ought to be placed upon the contingency of the fluctuation of stocks. I may, perhaps, in this connection, be allowed to mention the fact that, to meet the payments on the building during its construction, it became my duty from time to time to sell portions of the stock in which the building fund had been invested. In doing this, by waiting a few days, in some cases a considerable profit might have been made, and in other cases a loss would have ensued. These fluctuations gave rise to considerable anxiety and an unpleasant sense of responsibility, from which I was relieved by adopting the rule always to sell on the day in which the money was actually required. A similar policy has been adopted in regard to the sale of the gold received as the semi-annual interest on the permanent fund, which is always disposed of on the day in which it is paid by the Treasury, and the proceeds placed to the credit of the Smithson account in the First National Bank.

The income from the fund during the year, including the premium on gold, was $43,192.50. The expenditures were as follows: viz, $9,032.41 for repairs, and reconstruction of the building, and furniture; $11,302.64 for salaries and general expenses; $15,431,93 for publications and researches; $8,132.95 for museum; $4,455.36 for exchanges, etc.; making an aggregate of $48,355.29, indicating an apparent excess of, expenditures over receipts of $5,162.79. But to balance this excess there remained in the United States Treasury, as previously stated $5,000 of the appropriation for the museum which had not been drawn.

Besides the foregoing, $20;000 were expended on the building, and $4,976 for the care of the museum from appropriations by Congress, a more detailed account of which will be found in a subsequent part of this report.

As stated in the last report Congress has indicated its intention to make appropriations for the independent support of the national museum, under the care of the Institution, and hence, in giving an account of the operations of the whole establishment, it is proper to divide them into two classes, those which relate to the legitimate objects of the Smithsonian Institution and those which pertain to the care and exhibition of the specimens of the national museum. In the following account we shall adopt this division.

OPERATIONS OF THE INSTITUTION.

Publications.—The publications of the Institution are of three classes —the Contributions to Knowledge, the Miscellaneous Collections, and

the Annual Reports. The first consist of memoirs containing positive additions to science resting on original research, and which are generally the result of investigations to which the Institution has in some way rendered assistance. The Miscellaneous Collections are composed of works intended to facilitate the study of branches of natural history, meteorology, etc., and are designed especially to induce individuals to engage in studies as specialties. The Annual Reports, beside an account of the operations, expenditures, and condition of the Institution, contain translations from works not generally accessible to American students, reports of lectures, extracts from correspondence, &c.

During the past year the seventeenth volume of the *Contributions* has been distributed. It consists of a single memoir, by Lewis H. Morgan, esq., of 602 quarto pages, illustrated by thirteen plates, in three parts: First, a descriptive system of relationship of the Aryan, Semitic, and Uralian families; second, the classificatory system of the Ganowánian family; and third, a classificatory system of the Turanian and Malayan families. This volume has been distributed to institutions in this country and abroad, and has met with approval as an important contribution to the science of anthropology.

The paper on "The rain-fall in the United States," referred to in the last report, has been printed, but it was found necessary to make additions and corrections, especially in the charts, which have prevented its distribution to the present time.

A short paper by Professor William Ferrel, on "Converging series, expressing the ratio between the diameter and the circumference of a circle," which was read before the National Academy of Sciences, has been printed during the past year, and will form part of the eighteenth volume of the Contributions.

The papers of General J. G. Barnard, on "Problems of rotary motion presented by the gyroscope, the precession of the equinoxes, and the pendulum;" of Mr. J. N. Stockwell, on "Secular variations in the orbits of the eight principal planets;" and of Dr. H. C. Wood, on "Fresh-water algæ," have been placed in the hands of the printers during the past year, and will also form parts of the eighteenth volume of Contributions, to be issued in 1872.

Another paper in course of publication is by Professor William Harkness, of the United States Naval Observatory. It contains the records and discussions of a series of magnetic observations by the professor during the cruise of the Monitor Monadnock, from Philadelphia to San Francisco, in 1865–'66. The investigation was undertaken because the vessel was heavily armored and the voyage extended far into both hemispheres, thus affording a favorable opportunity of submitting Poisson's theory of the deviations of compasses on iron ships to the test of rigorous observations, which had never been done before. The disturbing force acting on a compass-needle is expressed as a function of the force of terrestrial magnetism, and of certain constants peculiar to the ship upon which the

compass is situated. Hence, in addition to swinging the Monadnock, or, in other words, turning its bow in succession to every point of the horizon to determine the deviations of her compasses from the true north, it was necessary to make observations on terrestrial magnetism on shore, and these, in their turn, required the determination of time, latitude, and azimuth. The memoir is divided into five sections: 1st, introduction; 2d, description of stations; 3d, astronomical observations; 4th, observations on terrestrial magnetism; 5th, observations on the magnetism of the ship. The results obtained may be summed up as follows: The latitude of seven points was determined. The magnetic declination, inclination, and horizontal force were obtained at seventeen stations, eleven of which were in South America. The ship was swung, and the deviations of all her compasses, seven in number, were observed and compared with those deduced from theory at ten places so situated as to afford very great changes in the terrestrial magnetic elements. For all these compasses the co-efficients or quantities necessary to reduce Poisson's general equations were determined separately, with considerable accuracy. The agreement between theory and observation was found to be sufficiently exact for the purposes of navigation, but not entirely satisfactory in a scientific point of view. It appears from the results that certain parts of the theory require further investigation; and from the observations it is shown that when a vessel is swung for the first time near where she was built it is impossible to make any reliable estimate of the changes which the deviations of her compasses will undergo upon a change of magnetic latitude.

The memoir of Dr. E. W. Hilgard, on "The geology of Lower Louisiana, including the Petite Anse region," mentioned in the last report, has been received from the author, and the illustrations put in the hands of the engraver.

The work of Professor S. Newcomb, on "A new orbit of Uranus as influenced by the perturbations of Neptune and other bodies," is still in progress. In the calculation of the tables for indicating the places of Uranus, the assistance of Dr. Kampf, late of Germany, has been secured at the expense of the Institution. The labors of Professor Newcomb are gratuitously given for the advance of science.

The articles for the *Miscellaneous Collections* mentioned in the last report, viz: DeSaussure's "Monograph of hymenoptera," Uhler's "Monograph of hemiptera," and Watson's "Botany of the region west of the Mississippi," are still in the course of preparation, and some of them will be published during the next year.

The "Arrangement of the families of Mollusks," by Professor Theodore Gill, described in the last report, has been published. It forms an octavo pamphlet of 65 pages, and will be of importance in arranging the specimens of the national museum, as well as those of other collections in this country.

A fourth edition of the "List of foreign institutions in correspon dence

with the Smithsonian" is now in press, as well as a similar list, embracing all the scientific, educational, and literary establishments in the United States, prepared by Mr. Rhees, chief clerk of this Institution.

New editions of the following works were printed during the year: Physical and meteorological tables, Catalogue of Smithsonian publications, Review of American Birds, Classification of coleoptera, Bibliography of North American conchology, Researches on Hydrobiinæ, Check lists of fossils, Instructions relative to shells, insects, tornadoes, Museum miscellanea, Catalogue of birds, &c.

In addition to the above, the following new circulars of instructions have been prepared and distributed:

Circular relative to observations on thunder-storms.

Circular relative to the construction of lightning-rods.

Circular relative to collection of altitudes from railway and canal explorations.

The Institution many years ago prepared and published lists of words and phrases for collecting vocabularies of the several Indian languages of North America, which were distributed to officers of the Army, missionaries, Government exploring parties, and private individuals, and from these have been received over two hundred separate vocabularies. These include the tribes of Oregon, Washington, California, northwest coast, New Mexico, Arizona, and the prairies. They have all been placed in the hands of George Gibbs, esq., for critical study and revision, and after consultation with some of the principal philologists of the country, it has been concluded to publish them, as it were provisionally, for distribution, as materials for ethnological and linguistic investigations. Mr. Gibbs has kindly undertaken to superintend the printing, and it is proposed to put them to press immediately. They will not only be of great use to the student of ethnology, but also be of practical value to missionaries, teachers, and all who are brought into intercourse with the aborigines of the country. No publication of the Institution has been called for more frequently than that of the Grammar and Dictionary of the Dakota language. Unfortunately, it was published at an early period of the Institution, and was not stereotyped; otherwise we would long since have struck off a new edition.

The *Report* of the Institution for the year 1870 was printed, as heretofore, at the Government expense, and we are gratified to state that a larger number of extra copies was ordered than of the previous year. The demand for these reports is, however, constantly increasing; and we would renew the recommendation made before, that Congress not only order a larger edition of the report for the coming year, but that a new edition be printed from the stereotype plates of previous volumes. In addition to the report of the Secretary, giving an account of the operations, expenditures, &c., of the Institution, and the proceedings of the Board of Regents, the report for 1870 contains

the following articles: A eulogy on Professor Alexander Dallas Bache, late Superintendent of the Coast Survey, and president of the National Academy of Sciences, prepared by Professor Henry at the request of the Board of Regents of the Smithsonian Institution; a lecture on Switzerland, by Professor Bache, to illustrate his style, with notes, bringing the subject down to the present time, by Jno. Hitz, esq., consul general of that country; on a physical observatory, by Professor Henry; memoirs of Arago, Sir John Herschel, Henry Gustavus Magnus, Professor Chester Dewey; an original article on the nature and origin of force, by W. B. Taylor, of the United States Patent-Office; a discourse on induction and deduction, by Liebig; an address on the relations of food to work and its bearing on medical practice by Rev. Samuel Haughton, of Dublin; a lecture on hydrogen, by Dr. J. E. Reynolds; a lecture on the identification of the artisan and artist, by Cardinal Wiseman; the diamond and other precious stones, translated from the French of M. Babinet; a large number of original communications on ethnology, physics, and meteorology.

The following are the rules which have been adopted for the distribution of the publications of the Smithsonian Institution:

1st. To learned societies of the first class which present complete series of their publications to the Institution.

2d. To libraries of the first class which give in exchange their catalogues and other publications; or an equivalent, from their duplicate volumes.

3d. To colleges of the first class which furnish meteorological observations, catalogues of their libraries and of their students, and all other publications relative to their organization and history.

4th. To States and Territories, provided they give in return copies of all documents published under their authority.

5th. To public libraries in this country, not included in any of the foregoing classes, containing 10,000 volumes, and to smaller libraries where a large district would be otherwise unsupplied.

6th. To institutions devoted exclusively to the promotion of particular branches of knowledge are given such Smithsonian publications as relate to their respective objects.

7th. The *Reports* are presented to the meteorological observers, to contributors of valuable material to the library or collections, and to persons engaged in special scientific research.

Exchanges.—The system of international exchanges has been largely increased in extent and efficiency during the past year. The number of foreign establishments to which the Smithsonian and other publications are distributed, and from which returns are received, now amounts to nearly two thousand. The system includes not only all the first-class libraries, and societies of established reputation, but also a considerable number of the minor institutions of the Old World. The following

table exhibits the number of foreign institutions in each country with which the Smithsonian is at present in correspondence:

Sweden	19	Turkey	11
Norway	22	Africa	18
Iceland	2	Asia	36
Denmark	26	Australia	26
Russia	154	New Zealand	11
Holland	65	Polynesia	1
Germany	573	South America	33
Switzerland	63	West Indies	11
Belgium	126	Mexico	8
France	190	Central America	1
Italy	149	British America	27
Portugal	20	General	5
Spain	11		
Great Britain and Ireland	323	Total	1,937
Greece	6		

During the year, 1,778 packages, containing many thousand different articles, were transmitted to foreign countries. These packages filled 108 large boxes, having a cubical content of 772 feet and weighing 29,950 pounds. The parcels received at the Institution for parties in this country, in addition to those for the Smithsonian library, numbered 3,952.

As in previous years, the Institution has received important aid from various steamer and railroad lines in the way of free freights, without which the expense of carrying on the system would be far beyond the means at our command. Acknowledgment is again due for the liberality of the following companies: Pacific Mail Steamship, Panama Railroad, Pacific Steam Navigation, New York and Mexican Steamship, New York and Brazilian Line, North German Lloyds, Hamburg American Packet, French Transatlantic, Inman Line, Cunard Line, Anchor Line, Union Pacific Railroad. The Adams Express Company also continues its liberal policy in regard to freight for the Institution.

The advantages which result from the international scientific exchanges have become so apparent that establishments similar in this respect to the Smithsonian are beginning to be formed in different parts of Europe. A central scientific bureau for the Netherlands has been established in Amsterdam, the object of which is to receive and transmit packages for different parts of the world, and in this country to co-operate with the Smithsonian Institution.

The international exchange is not confined alone to the transactions and proceedings of societies, but also includes scientific works of individuals. We frequently receive from persons abroad who can afford the cost, copies of works to be gratuitously distributed among institutions and libraries in this country, and also scientific works from

persons in this country to be distributed abroad. In most cases the list of distribution is made out by the party sending the copies, but sometimes the selection of recipients is left to the Institution. Among the articles distributed in this way which we should have mentioned in the last report, is the narrative of an exploration to Musardo, the capital of the Western Mandigoes, through the country east of Liberia, by Benjamin Anderson, a young man of pure negro blood. The narrative was printed without correction from the original manuscript at the expense of Mr. H. M. Schieffelin, of New York, and nearly the whole of the edition was presented to the Institution for distribution.

The labors of the Institution in the way of exchanges can scarcely be too highly estimated. Whatever tends to enlarge the sympathies of individuals and of nations, to render the progress of thought in each country common to all, must serve an important end in advancing the world in intelligence and morality. The works which are received through this system, by the several institutions of the United States, contain the records of the advance of science in all foreign countries at the present day. They do not consist of ordinary books, but special accounts of the actual increase of knowledge by the human family, or an account of that which constitutes the advance of man in a higher and wider intellectual development.

To afford information as to the regulations adopted for transmitting packages intended for exchange, a circular, of which the following is a copy, has been widely distributed:

1. Every package, without exception, must be enveloped in strong paper, and so secured as to bear separate transportation by express or otherwise.

2. The address of the institution for which, or the individual for whom, the parcel is intended must be written legibly on the package, and the name of the sender in one corner.

3. No single package must exceed the half of a cubic foot in bulk.

4. A detailed list of addresses of all the parcels sent, with their contents, must accompany them.

5. No letter or other communication can be allowed in the parcel, excepting such as relates exclusively to the contents of the package.

6. All packages must be delivered in Washington free of freight and other expenses.

Unless all these conditions are complied with the parcels are not forwarded from the Institution; and on the failure to comply with the first and second conditions, they are returned to the sender for correction.

The Institution recommends that every parcel should contain a blank acknowledgment, to be signed by the recipient and returned through the agent of the Institution, or, what is still better, directly by mail to the sender. Should exchanges be desired for what is sent, the fact should be explicitly stated on the accompanying circular. Much disappointment is frequently expressed at the absence of any return in kind for transmis-

sions; but unless these are specifically asked for they will fail in many instances to be made. It will facilitate the labor of the Institution very greatly if the number corresponding to the several addresses in the Smithsonian printed catalogue be marked on the face of each parcel; and for this purpose a copy of the work will be forwarded to all who apply for it.

Specimens of natural history will not be received for transmission, unless with a previous understanding as to their character and bulk.

Library.—The accessions to the library during the last year from the foreign exchanges have not been as large as they were the year before, on account of the war between France and Germany.

The following is a statement of the books, maps, and charts received by exchange in 1871, and which have been deposited in the National Library in accordance with arrangements made several years ago, and fully explained in previous reports:

Volumes:		
Quarto, or larger	277	
Octavo, or less	659	
		936
Parts of volumes:		
Quarto, or larger	625	
Octavo, or less	1,156	
		1,781
Pamphlets:		
Quarto, or larger	316	
Octavo, or less	1,482	
		1,798
Maps and charts		82
Total receipts		4,597

The following are some of the larger foreign donations received by the Smithsonian Institution in 1871:

From the Royal University of Norway, Christiania: 14 volumes, 37 pamphlets, and 3 charts.

Bergen Museum, Bergen, Norway: 11 volumes and 31 pamphlets.

Russian government, St. Petersburg: Engineering Journal, Artillery Journal and Ordnance Magazine for 1870; Caucasian statistics, 1869; Appendix to the Code of Laws, 1869.

Statistical bureau, Stockholm: Contributions to Swedish statistics, 26 parts, quarto.

Emperor of Germany: "Preussen's Schlösser und Residenzen," vol. xi, folio; and "Scriptores rerum Prussicarum," vol. iv.

F. Vieweg & Son, Braunschweig: 42 volumes and 12 pamphlets.

Hungarian Academy of Sciences, Pesth: 16 volumes and 63 parts, reports transactions, &c.

University of Pesth: 44 pamphlets, inaugural dissertations.

University of Leipsic: 104 pamphlets, inaugural dissertations.

University of Göttingen: 70 pamphlets, inaugural dissertations.

University of Bonn: 44 pamphlets, inaugural dissertations.

University of Königsberg: 144 pamphlets, inaugural dissertations.

University of Würzburg: 80 pamphlets, inaugural dissertations.

Board of Admiralty, London: 7 volumes, 36 charts, and 10 pamphlets.

British Museum: Catalogue of Syriac manuscripts, part ii; catalogue of prints; catalogue of satires, vol. i; hand list of birds, parts ii and iii.

Royal Society, London: Philosophical transactions, vol. 160, part i; proceedings, 119–123; catalogue of scientific papers, vol. iv; Greenwich magnetic and meteorological observations, 1868.

R. L. Simmonds, London: 18 volumes and 52 pamphlets.

Thomason College, Rourkee: 10 works on Civil Engineering.

Government Observatory, Sydney, Australia: Observations, 3 volumes and 55 parts.

Grand Ducal Court Library, Karlsruhe: 5 volumes and 3 parts.

University of Pisa: 22 volumes and 40 pamphlets.

The Minister of Agriculture, Industry, and Commerce, Florence: 27 volumes and 41 pamphlets.

Royal Institution for the Encouragement of Natural Sciences, Technology, &c., Naples: Atti, second series, volumes i–viii; quarto.

University of Chili, Santiago: 14 volumes and 5 pamphlets.

The value of the National Library still continues to be increased in the number and character of the books which are annually added to it, first by books purchased, second by the Smithsonian exchanges, and third by the deposit of books in accordance with the copyright law. As we have said in previous reports, the space for the accommodation of this valuable library—now the largest in the United States—is far too circumscribed even for the wants of the present time, without regard to those of the future. It is, therefore, proper to keep the proposition of a new and separate building constantly in mind. The necessity for such a building is not alone confined to the better accommodation of the books, but also includes greater facilities for consulting them by students, as well as by general readers, in the way of greater seclusion in separate spaces, and the number of hours during which the library is open. With a separate building, certain portions of it at least might be accessible during the evening, which, perhaps, would be of greater importance to Washington than a similar arrangement in any other city, on account of the large number of educated men in the various offices of the Government, who cannot avail themselves at other hours of the great advantage which the library affords for the prosecution of study.

It may be proper to add, in this connection, that the library now de-

posited in the Army Medical Museum, numbering 20,000 volumes of works relating to medical subjects, may be considered as part of the great National Library, and is rapidly increasing in the number and value of its contents by an annual appropriation from Congress.

In accordance with the original agreement the use of these books, as well as those now in the Capitol, is free to the Smithsonian Institution, and we may perhaps indulge the hope that the new building for the library, which is now contemplated, will be erected on the Smithsonian Grounds, perhaps as an extension of the present building.

As we have said, one source of the increase of the library is the copyright system. The number of these books would be increased, we think, and their character greatly improved, if an international copyright law were established, granting to the foreign author the same protection that is afforded to our own citizens. For example, we would ask, what would be the condition of the wool-grower if the manufacturer of cloth in this country had the power to obtain surreptitiously all the wool that he uses, paying nothing but for manufacturing the article? What encouragement is there to an author to produce an original work on any branch of science when the publisher can obtain one which will equally well answer his purpose from a foreigner without paying anything? But the question ought not to be decided on considerations even of this character; it belongs to the province of justice and morality. The results of the labors of the mind, which form the basis of all human improvement, ought not to be appropriated without remuneration, any more than the labors of the hand or of the machine.

Meteorology.—The impression has prevailed since the establishment of the meteorological system by the Government, under the direction of the Signal-Corps, that the observations which have been so long made under the direction of the Smithsonian Institution may now be discontinued. This idea is, however, erroneous. The object of the operations of the Signal-Service is principally one of immediate practical utility, viz, that of predicting the condition of the weather for a day or more in advance of the actual occurrence. This it is enabled to do by the fact previously established, that, as a general rule, disturbances of the atmosphere are propagated over a wide extent of the surface of the earth in an easterly direction. Besides the number of stations necessary for the practical predictions of the weather, a much more numerous series of stations and long-continued observations are required for determining the peculiarities of the climate, or for obtaining such information as may satisfy the requirements of the scientist, the physician, and the agriculturist. It is on this account that the more extended observations established by the Institution, and which have now been prosecuted for more than twenty years, are continued. It is true we would be gratified if the charge of this system were transferred to the Government, with more ample funds for its maintenance than can be afforded from the income of the Institution. But so long as an arrange-

ment of this kind is not effected, it becomes the duty of the Institution to continue the system with such improvements as the appropriation which can be made on account of it will allow. During the past year the number of stations has remained about the same, viz, 514, to which a large number of additional rain-gauges have been distributed. Besides these, meteorological observations are received from British America, Central America, Mexico, Bermuda, and some of the West Indies.

The tables and deductions of rain-fall have been printed, and are nearly ready for distribution.

The discussion of all the observations relative to the winds made under the direction of the Institution is still going on under the supervision of Professor Coffin. Like his former work on the winds of the northern hemisphere, it will consist mainly of abstracts of observations on the relative frequency of the different winds, both at the surface of the earth and in the higher regions, as indicated by the motion of the clouds, with their resultant directions, and the monsoon influences by which they are affected in the different seasons, or months of the year. Where *data* could be obtained the actual transfer of the air in miles is also given.

Where the places of observation are sufficiently remote from each other to admit of distinct delineation of the results, on maps of the scale it is proposed to use, separate computations are made for each; in other cases they are grouped by districts. The work will embrace the following material:

I. All the observations reported to the Smithsonian Institution from the year 1854 to 1869, inclusive, with some others in the earlier years.

II. All those made at the United States military posts, and reported to the Surgeon General, from the year 1822 to 1859 inclusive; and all those from posts west of the Mississippi for the succeeding ten years, up to the end of 1869.

III. All those at sea, collected at the United States Naval Observatory, so far as they have been published; *i. e.*, over all the oceans between the parallels of latitude 60° north and south, except a comparatively small portion of the North Pacific lying between the meridians 150° east and 165° west from Greenwich; and a few additional observations south of Cape Horn.

IV. Those taken at sea, beyond these limits, by Arctic and Antarctic explorers.

V. Those at several hundred stations in other parts of the globe.

This material, though very much more condensed than in his former work, will still make a considerably larger volume.

In the discussion the whole surface of the earth is divided into zones by parallels of latitude drawn 5° asunder, and observations in these zones investigated in regular order from the North to the South Pole; commencing with the observations in each at the 180th meridian from Greenwich, and proceeding easterly to the same meridian again. Professor Coffin hopes to complete the tabular work in the course of two or

three months, when nothing will remain to be done but the maps and some general deductions.

To defray the cost of the labor in the preparation of this work other than that of Professor Coffin himself, an appropriation has been made from the income of the Institution. The world will not only therefore be indebted to the Institution for the publication of the work, but also for the collection of the material and a part of the expense of the reductions.

I may mention that the previous publication by the Institution of the Winds of North America has been largely made use of by the English Board of Trade in constructing their wind-charts of the northern oceans, and that the work now in process of preparation will be of especial value for a similar purpose.

The temperature observations are still in progress of reduction, two computors being engaged upon the work. The progress of their labors has, however, frequently been interrupted by calls from different portions of the country for reports on the climate of different districts.

The following is an account of the present condition of this part of the general reductions:

The collection and tabulation, in the form of monthly and annual means, of all accessible observations of the atmospheric temperature of the American continent and adjacent islands, have been completed to the close of the year 1870, and extensive tables representing the daily extremes, or the maximum and the minimum at the regular observing hours, have been prepared.

An exhaustive discussion of all the observations available for the investigation of the daily fluctuations of the temperature has been made, and this part of the work is now ready for the printer.

The discussion of the annual fluctuations of the temperature has been commenced and carried as far as the present state of other parts of the discussion would permit.

The construction of a consolidated table giving the mean results, from a series of years, for each month, season, and the year, at all of the stations, which will probably exceed 2,500 in number, has been begun and completed for that part of the continent lying north of the United States, and also for several of the States. This is perhaps the most laborious, as it is one of the most important parts of the discussion. In many of the large cities there are numerous series, made by various observers, at different hours, all of which have to be brought together, corrected for daily variation, and combined to obtain the final mean. To give some adequate idea of the time and labor involved in the preparation of these tables, it may be mentioned that, in the State of New York alone, there are about three hundred series, which are derived from nearly two million individual observations.

The principal sources from which the general collection of results has been derived, may be enumerated as follows:

1. The registers of the Smithsonian Institution, embracing upward of three hundred large folio volumes.

2. The publications of the Institution, Patent-Office, Department of Agriculture, and public documents.

3. All the published and unpublished records of the United States Army, United States Lake Survey, and United States Coast Survey.

4. The large volume compiled by Dr. Hough, from the observations made in connection with the New York University system, the records made in connection with the Franklin Institute, and those obtained from numerous observatories and other scientific institutions.

5. The immense collection of printed slips, pamphlets, manuscripts, &c., in the possession of the Smithsonian Institution.

The work has been somewhat retarded by the collection and tabulation of the rain-fall, to the end of 1870 for the Smithsonian stations, and to the end of 1871 for the United States military posts.

Beside the discussion of the observations on temperature, rain, and wind, there remain those relative to the pressure of the atmosphere, and its humidity; also those which are classed under the head of casual phenomena, such as thunder-storms, tornadoes, auroras, meteors, early and late frosts, progress of vegetation, opening and closing of rivers, &c. These will be put in hand as soon as the funds of the Institution which can be devoted to meteorology will permit the requisite expenditure.

Explorations and collections.—As in previous reports, it is proper to make a distinction between the collections of the Institution and the specimens exhibited in the public museum. The former are collected as a part of the operations of the Institution, to advance science and promote general education; they are usually in great numbers, including many duplicates of the same species. A type specimen of each species and variety is deposited in the National Museum. The remainder are reserved for distribution to foreign establishments, and to societies, colleges, and academies in this country, after they have been submitted to scientific investigation and duly assorted and labeled.

At the last session of Congress an appropriation was made of $12,000 for the continuance of an exploration of the region of the Colorado of the West and its tributaries, by Professor J. W. Powell, to be expended under the direction of the Smithsonian Institution. The region here mentioned is one of the most interesting in a geological point of view of almost any in this or any other country. The Colorado of the West and its tributaries traverse chasms in some places over a mile below the general surface of the country, and present in different places at one view sections of the principal members of the known geological formations of the continent of North America. The region surveyed lies between the 35th and 39th parallels of latitude, and the 109th and 115th meridians of west longitude. It includes the headwaters of the Uintah, the Price, the San Rafael, the Paira, the Kanab, and the Virgin Rivers, the lower portion of the Grand, and a part of the

Colorado. In the year 1870 a general reconnaissance of the country had been made, and several routes through it explored from Salt Lake City to the Green and Colorado Rivers, and depositaries of supplies established. The operations of Professor Powell and party under his command in 1871, consisted, first, in an exploration of the Green River from the point where it is crossed by the track of the Union Pacific Railway to its junction with the Grand, or where the union of these rivers forms the Colorado of the West, and the exploration of this to the mouth of the Paira; second, the establishment of a base-line in the valley of the Kanab, from which a system of triangles was extended westward to the valley of the Virgin River, southward and eastward to the Colorado, and northward to the Paira; third, a geological survey of the region, and the collection of a series of specimens of geology and mineralogy; fourth, an ethnological study of the Indians of the region, including their mythology, manners and customs, means of subsistence, language, &c., together with a full collection of all their implements and articles of manufacture. The explorations and surveys of Professor Powell have furnished additions to our knowledge of a portion of our public domain previously but very imperfectly known, which, together with the extensive series of specimens which he has added to the collections of the Institution and the National Museum, fully repay the appropriation which was made from the national Treasury on this account. I have certified to this effect to Congress, and respectfully commend the application of Professor Powell for an additional appropriation to complete the survey.

The alleged decrease of the food-fishes of the coast and lakes of the United States led to the passage of a law at the last session of Congress, directing the President to appoint a commissioner of fish and fisheries, for the purpose of making inquiries upon the subject. Professor Baird, assistant secretary of this Institution, whose attention has been directed for some time both to the scientific and economical relationships of the fishes, received the appointment, and proceeded in June last to Wood's Hole, a convenient point on the Massachusetts coast, from which to prosecute his inquiries. With the aid of an appropriation from Congress, and facilities afforded by various departments of the Government, he was enabled to carry on an extended research during a period of several months. In this work he had the special co-operation of Professors Verrill and Smith, of Yale College, in the investigation of the invertebrate fauna of the coast in its relation to the food-fishes; of Professor Gill, of Washington, in the study of fishes themselves; and of Professor Hyatt, of the Boston Society of Natural History, Professor Jenks, of Middleborough, Dr. A. S. Packard, jr., of Salem, and W. G. Farlow, of Cambridge, in other branches of the investigation. Among other gentlemen interested in the researches, who visited Wood's Hole during the season, were Professor L. Agassiz, Professor J. Gwyn Jeffreys, of England, Colonel Lyman, Professor D. C. Eaton, Professor W. H. Brewer, Professor J. H. Trumbull, and Professor

W. D. Whitney. With this corps of helpers it was quite possible to make a very thorough exploration of everything connected with the general economical and natural history of the fauna of the waters on the southern coast of New England; and while Professor Baird and some of his party were engaged in visiting different parts of the coast and taking testimony as to the actual condition of the fisheries, others of the party were occupied in trawling, dredging, and in otherwise collecting the various inhabitants of the sea.

A large amount of information was gathered which will have an important bearing upon the objects of the commission, and of which Professor Baird will present a report in full to Congress at an early date. The inquiries include numerous observations in regard to currents, temperatures, distribution of life at different depths, &c. The collections made during the exploration were very extensive, embracing a full series of all the fishes of the coast, as well as of the invertebrates, from which sets will be made up for distribution by the Institution. Among other results of the expedition should be mentioned a series of nearly three hundred photographs of a large size, representing all the fishes found, in their various stages of growth, the whole constituting an almost unique collection of portraits, and especially important as relating to the larger fishes, like the sharks, rays, sturgeons, tunnys, sword-fish, &c.

Dr. Hayden, in the prosecution of his researches as United States geologist for the Territories, gathered very large collections of minerals, skins of mammals and birds, eggs, &c., filling forty-five boxes, illustrative of the natural history of Montana, and of the region about the head-waters of the Yellowstone, a report of which he has presented to the Secretary of the Interior. This exploration has excited a great degree of interest on account of the wonderful series of geysers and remarkable scenery, of which it has furnished an authentic description. Indeed such has been the interest manifested in the Yellowstone district that a proposition, originally made by Mr. Catlin as early as 1832, has been revived and presented to Congress, to reserve the country around these geysers as a public park. It is thought this proposition will be adopted by the Government; and if so, we doubt not that in time the Yellowstone region will become a favorite resort for travelers from every part of the world.

After reserving a full set of the specimens for the National Museum the duplicates of Hayden's collections will be made up into sets for distribution.

Among the persons to whom the obligations of the Institution are particularly due for the magnitude and variety of contribution of specimens we should mention Mrs. James A. McMinn. She gave the valuable herbarium described in the last report, and has since presented the entire collection of objects of natural history belonging to her late husband, who was for many years a correspondent of the Institution. This gentleman had accumulated large numbers of minerals,

fossils, plants, &c., which filled twenty-six boxes, and were presented to the Institution to be used as it might deem best for the interest of science. Many of the specimens are duplicates, but are valuable as material for distribution.

To Mr. George A. Boardman the Institution is indebted for extensive collections of birds and skeletons from Florida, and also three complete skeletons of the moose from Nova Scotia.

To his son, Mr. Charles A. Boardman, and to Mr. S. W. Smith we owe acknowledgments for fine specimens of the moose and caribou.

Dr. Yarrow, assistant surgeon United States Army, Fort Macon, North Carolina, has sent a large collection of skulls and skeletons of the porpoises of the southern coast, as well as many Indian relics, fishes, shells, &c.

From Professor Sumichrast we have received additional collections of birds, reptiles, &c., illustrative of the natural history of Tehuantepec. The name of this gentleman has frequently been mentioned in previous reports as a large contributor to the Smithsonian Collections.

Captain Charles Bryant, in charge of the fur-seal islands of Alaska, has contributed full series of skins, skulls, and skeletons of seals, walrus, &c., abounding in that region.

To the Army Medical Museum the Institution is indebted, as heretofore, for numerous specimens in ethnology and natural history, in accordance with an arrangement made several years ago, by which, in consideration of the transfer to it from the Institution of human crania, all other objects of an anthropological character received by that museum were to be placed in the Smithsonian Collection.

Some interesting specimens have also been received from the Department of Agriculture under a similar arrangement of exchange.

Dr. Destruges has contributed the skeleton of a sloth, and Mr. Henry Hague that of a Guatemalan tapir; Professor Poey a skeleton, and Dr. Gundlach a specimen in alcohol of *solenodon*, a rare insectivorous mammal of Cuba; Mr. Hernberg and Colonel Gibson, skeletons of buffalo; Mr. Isaac H. Taylor, of Boston, crania of South African mammals; Captain Scammon, of the United States revenue-service, skulls of whales and other cetaceans.

Although but few birds have been received, some valuable specimens from Veragua were contributed by Mr. Salvin; from Brazil, by Mr. Albuquerque; from Buenos Ayres, from the national museum under the charge of Professor Baumeister; from Labrador, from C. G. Brewster.

Mr. Strachan Jones has furnished a number of eggs from the Lower Slave Lake, and Mr. Charles R. Bree specimens of eggs of the *Larus gelastes* from Turkey.

The reptiles received have been principally specimens gathered by the naturalists of the Tehuantepec and Darien expedition.

Fine specimens of the celebrated *Eozoon canadense* have been re-

ceived from Mr. E. Billings, of Canada, and Dr. Josiah Curtis, of Chelmsford, Massachusetts.

Mr. Brittan has contributed Permian fossils from Kansas; Mr. U. P. James, a series of Ohio Lower Silurian fossils; Mr. S. A. Miller, fossils from Ohio, and a fossil tree-trunk of the genus *Psaronius;* Mr. D. M. Shafer, Lower Silurian fossils.

Specimens of woods have been presented by Mr. George Davidson, of the Coast Survey; of birds, reptiles, and fishes, from Illinois, by Mr. R. Ridgeway; fishes, reptiles, and vertebrates, by W. H. Clarke, of the Tehuantepec expedition.

As usual, the amount of material received from the Old World is much less than that from our own continent, the most noteworthy being a collection of specimens in alcohol, presented by the museum of Bergen, in Norway.

Mr. Knudsen has sent a collection of human crania from the Sandwich Islands. The museum of Wellington, New Zealand, under the charge of Dr. Hector, has presented casts of the eggs of the *Dinornis* and *Apteryx*, with casts of bones of the former animal, and various ethnological objects.

To Mr. Genio Scott, and to Messrs. Middleton & Carman, of New York, the Institution is indebted for specimens of *Cybium caballa*, or *Cero*, a food-fish but lately indicated as occurring on our coast. The museum at Bergen has also supplied a number of fishes peculiar to the coast of Norway.

All the specimens of ethnology and natural history, not at present on exhibition in the public museum, are now stored in the west basement, and the various operations connected with unpacking, labeling, cleaning, assorting, poisoning, etc., have been transferred to that part of the building. The necessity of making this transfer in a limited space of time involved considerable derangement of the specimens, and much time has been occupied during the fall and winter in re-arranging them. This work, however, is in great measure accomplished; and Professor Baird, with assistants, is now occupied in assorting and classifying the material for the purpose of selecting duplicates to be distributed for the advance of science. A very extensive distribution of specimens has been made during the year, partly in the way of giving general series for educational purposes to colleges, academies, and scientific institutions, and partly in the way of exchanges with the principal museums at home and abroad. The amount of work done in the distribution of specimens will be shown in the following table:

Distribution of duplicate specimens to the end of 1871.

Class.	Distribution in 1871.		Total to the end of 1871.	
	Species.	Specim's.	Species.	Specim's.
Skeletons and skulls	111	156	325	827
Mammals	25	40	941	1,822
Birds	410	477	22,940	35,428
Reptiles	100	100	1,841	2,970
Fishes	42	100	2,477	5,311
Eggs of birds	151	304	6,606	16,698
Shells	2,534	3,000	83,712	186,157
Radiates	.....	.....	583	778
Crustaceans	.....	.....	1,078	2,650
Marine invertebrates	.....	.....	1,838	5,152
Plants and packages of seeds	3,000	4,000	18,503	25,063
Fossils	151	151	4,109	10,135
Minerals and rocks	1,000	1,400	4,630	9,974
Ethnological specimens	152	152	1,295	1,342
Insects	204	204	1,836	3,150
Diatomaceous earths	1	55	29	623
Total	7,881	10,139	152,743	308,080

As heretofore, a great amount of labor has been expended in cataloguing the specimens received, their enumeration having been carried forward from 164,700 to 169,750, the increase representing about the average of the last ten years.

As in previous years, the collections of the Institution have been placed freely at the service of naturalists in this country and Europe, and large numbers of specimens are now in the hands of collaborators. Among these may be mentioned Dr. Elliott Coues, assistant surgeon, United States Army, who has undertaken a critical revision of a special family of *Rodents* of North America. This group is very extensive, embracing numerous genera and species differing entirely from the corresponding families in the Old World. The large amount of material we have placed in the hands of Dr. Coues will enable him to solve many interesting questions as to the geographical distribution and zoölogical affinities of the family in question. Dr. Coues' memoir on this group will be published by the Institution, and series of type specimens will be distributed to other museums. To Professor Cope have been intrusted, as before, the collections of reptiles, and other material has been furnished to Professor Leidy, Professor Marsh, Professor Agassiz, Dr. Stimpson, and others. Type specimens of American birds have been sent to Messrs. Sclater, Salvin, and Dresser, of London, for use by them in the preparation of descriptive works.

In accordance with the same policy a few years ago the alcoholic invertebrates were intrusted to Dr. Stimpson of the Chicago Academy of Sciences for study and distribution into sets of duplicates. Unfortunately, however, this collection, although deposited in a building supposed to be fire-proof, was destroyed in the disastrous fire of 1871. The misfortune was not alone confined to the loss of the specimens, but included also the results of years of labor of Dr. Stimpson, the great object of his scientific life, the publication of which was looked forward to with interest by all engaged in the study of natural history.

The *ethnological* specimens collected by the Institution to illustrate the arts, manners, and customs of the present Indians and the more ancient inhabitants of the American continent, are unsurpassed in number and variety, and are constantly increased by special efforts in the way of correspondence and small appropriations for explorations. The greatest additions to the collections received during the past year have been in this department, an account of some of the more important of which will be of interest.

From Captain C. F. Hall, the intrepid explorer, now, we trust, successfully prosecuting his researches in northern Greenland, we have received the entire series of relics of Sir John Franklin, obtained by Captain Hall during his last visit to the north, as also the relics of the Frobisher expedition, which wintered on Frobisher Bay several hundred years ago. To these were added a number of specimens illustrative of the habits and manners of the Esquimaux, and showing their relationship to, as well as their differences from, a corresponding series belonging to the Esquimaux of the Mackenzie's River region, furnished to the Institution by Mr. R. McFarlane and some of his colleagues of the Hudson's Bay service.

From the northwest coast of North America specimens have been furnished by Mr. George Gibbs, illustrating many points in the ethnology of the savage tribes; and specimens of dresses from Mr. Jos. T. Dyer.

Lieutenant Ring has sent specimens obtained from graves in Alaska and in British Columbia. Dr. Yates, of California, has added to his previous donations large Indian mortars and the crania obtained from sundry mounds.

Dr. Palmer collected for the Institution a very interesting series of stone implements from ancient ruins in Arizona, and Major Powell has furnished a full series of the implements, utensils, dresses, &c., of the Indians of the valley of the Colorado. Dr. Irwin, of the Army, has also added to this series.

From Colorado Territory we have specimens from Dr. Berthoud, indicating, in his opinion, an antiquity of the human race in that region far beyond that usually ascribed to it.

Additions from New Mexico are represented by specimens of blankets and other manufactures of the Navajo Indians; as also by a loom contain-

ing a part of an unfinished blanket, showing the mode of weaving, presented by Governor Arny.

A series of bone implements of remarkable character, and different from any we had previously possessed, together with other interesting objects from ancient graves in Michigan, have been presented by Dr. Irwin.

Mr. Andrews has contributed stone implements and other objects from Tennessee; Mr. J. Fisher, very interesting copper implements, and Mr. Peter, stone objects from Kentucky. Rev. D. Thompson and Mr. Clark have furnished stone implements from Ohio. Mr. Hotchkiss, of Louisiana, has furnished a remarkable series of stone lances and knives, some of them being of very great length and of beautiful finish. Mr. Keenan, of Mississippi, has supplied a variety of Indian implements.

From Georgia we have an extensive collection made by the late Colonel Floyd, and kindly presented by his heirs through the mediation of Colonel McAdoo; and from Messrs. W. and A. F. McKinley, a general ethnological collection of great value. The accessions from Florida are quite numerous, but the most important consist of a series of implements and crania from the mounds near Sarasota, presented by Mr. J. G. Webb. Among these are broken fragments of skulls, completely silicified, and quite unique in this respect. Rev. J. Fowler, of New Brunswick, has supplied a valuable collection gathered in his vicinity. From Mexico we have received a collection of ancient vases of remarkable beauty, deposited by Mrs. General Alfred Gibbs; and another collection of a similar character, presented by the Natural History Museum of Mexico; as also some by Dr. Penafiel, one of its officers.

Mr. Riotte has furnished an interesting series of diminutive figures, dressed to represent the costumes of the aborigines of Guatemala.

Dr. Flint, of Nicaragua, has sent various specimens of ancient pottery obtained near Omatope, and similar articles have been received from Dr. Van Patten, obtained in Costa Rica.

From Peru the most interesting accessions are two mummies from a burial-place at Arica, accompanied by various articles, presented by Mr. Henry Meiggs, the well-known railway engineer of South America. From Brazil we have received a series of the bows and arrows used by the natives of that country, and presented by Mr. Albuquerque.

Among the most important additions to the collections should be mentioned a large number of Lacustrian implements from Switzerland, from Professor Pagenstecker, of Heidelberg, Mr. Messikomer, of Zurich, and Professor Rutimeyer, of Basle. The latter gentleman has also added an extensive series, properly identified and labeled, of the various kinds of domestic animals used by the builders of the lake dwellings.

An interesting collection was presented by Mr. di Cesnola, United States consul to Cyprus, embracing numerous specimens of pottery obtained by him in his excavations in the site of the ancient Idalium. Some of these are believed to be purely Phœnician in their character,

and others of a later date, all of them characterized by great beauty and size.

One of the most interesting additions to the department of ethnology is the cast of the Tanis stone, on which is a trilingual inscription recently obtained from some excavations made at Tanis, on the eastern or Pelusiac branch of the Nile, and belonging to the museum of Egyptian antiquities at Cairo. The original is a block six feet high, two and a half feet broad, and a foot thick, with the top arched. One side is occupied partly by hieroglyphic inscriptions, together with a Greek translation of the same, while a portion of the left side is occupied with an equivalent inscription in the Demotic character. This stone occupies a position in Egyptology similar to that of the "Rosetta stone," except that it is much more perfect, and will probably aid much in deciphering the hieroglyphics. The cast was taken by the instrumentality of Dr. Lansing for presentation to Monmouth College, Illinois, but at his request and that of Mr. S. H. Scudder, and by permission of the authorities of that college, it was sent to the Institution to be copied. Unfortunately, it was very much broken in the transit, and required patient labor on the part of a skillful modeler to restore it to anything like its original condition. When this is accomplished a mold and casts will be taken, and the original sent to the college. In this connection we may mention that the inscriptions on the stone have been carefully studied by Dr. G. Seyffarth, an eminent Egyptologist, who visited Washington for the purpose, and will present a paper on the subject to the Institution, for publication.

Correspondence.—As we have said in previous reports, a very large amount of labor is devoted to correspondence. Beside those relating to the ordinary business of the establishment, hundreds of letters are received during the year containing inquiries on various subjects on which the writer desires information, and also many memoirs which are presented for publication. Among the former a large number are received from the five hundred meteorological observers who furnish, voluntarily, records of the weather, and who require frequent explanation of special phenomena. Among the papers submitted for publication are a large number containing speculations in reference to science which in many instances exhibit great industry and profound thought on the part of their authors, but which, nevertheless, cannot be considered as positive additions to knowledge founded on original research, and which, therefore, in accordance with the rules adopted by the Institution, cannot be accepted for publication. On account of the wide diffusion of elementary education in the United States, and the general taste for reading among all classes, there is no other part of the world, perhaps, in which there exists a greater diffusion of elementary scientific knowledge, and, perhaps, more activity of mind directed in the line of scientific thought. Much, however, of this, from a want of proper training, and the means of experiment and observation to verify deductions from *a priori* con-

ceptions, is unproductive of positive results. The Institution does not discard antecedent speculations provided deductions from them are made in the form of new results which are verified by actual phenomena. It is not enough that a new hypothesis may give a general explanation of a class of phenomena in order that it may be adopted; it must do more than this. It must point out new facts and phenomena which can be readily exhibited by experiment or verified by observation. Such advances have been made in physical science within the last two hundred years that most of the phenomena which lie, as it were, on the face of nature, have been studied and referred to general principles. In order, therefore, to make advances, in general physics, at least, apparatus, as well as training in the use of it, is essential to scientific research; and as but few, comparatively, possess the advantages of these, it rarely happens that investigations of much importance result from the speculations of the kind we have mentioned. In the line of mathematics, however, which requires no extraneous aid, and of natural history, in the study of which objects are everywhere presented, results of importance may be derived from the labors of isolated individuals who have no other assistance than books.

As a means of adult education, it may be remarked that from the first the Institution has encouraged the establishment of lyceums and scientific associations in all parts of the country, and as the number of these has constantly increased, they have added to our correspondence, and much more largely during the past year than during any one in the history of the Institution.

Miscellaneous items.—In 1863 Congress incorporated an association, under the name of the National Academy of Sciences, which should investigate, examine, experiment, and report upon any subject of science or art on which information might be required by any department of Government. Though this society was in no way connected with the Smithsonian Institution in its inception and organization, yet it is accommodated with rooms for its meetings in the Smithsonian building, and communications which are adopted by it are accepted for publication by the Institution.

A series of scientific inquiries has been referred to this society by different departments of Government, and the investigations in regard to them have principally been made under direction of members of the academy in this Institution. The organization of the scientific department of the North Polar Expedition under Captain Hall was intrusted by Congress to the National Academy, and the procuring of the instruments and the organization of the scientific corps were principally effected in connection with the Smithsonian Institution. A copy of the scientific instructions will be found in the appendix to this report.

In the law organizing the Light-House Board it is declared that it shall consist of two officers of the Army of high grade, two officers of the Navy, and two civilians of scientific reputation, whose services

might be at the disposal of the President of the United States, together with an officer of the Navy to act as naval secretary, and an officer of the Corps of Engineers of the Army, as engineer secretary. From the commencement of the board to the present time, the members from civil life have been the Superintendent of the Coast Survey and the Secretary of the Smithsonian Institution. During the whole period I have occupied the position of chairman of the committee on experiments, and have, with the exception of the summer I was in Europe, devoted my vacations to investigations relative to lighting-materials, fog-signals, and other duties connected with the light-house service. In October, 1871, on the retirement of Admiral Shubrick and the ordering of Admiral Jenkins to the charge of the East India squadron, I, being the oldest member, was elected chairman of the board. For the discharge of the duties of this position, in addition to the time of my summer vacation, I have made arrangements for devoting one day in each week. It is proper to observe that my office as a member of the Light-House Board, although one of much responsibility, and to which I have, during the last eighteen years, devoted a large amount of labor, is accompanied with no salary, the expense of traveling and subsistence being defrayed by an allowance of ten cents per mile.

The services which have been rendered to the Government by the Institution from its commencement to the present time are deserving of recognition. They include not only those connected with the National Academy, the Light-House Board, investigations now being carried on relative to fishes, the care of the Government collections, the organization of the natural history portions of the various exploring expeditions, the series of investigations made during the war, but also answers to the constant applications from members of Congress for information on special subjects. In no case has the Secretary or his assistants received any remuneration for labors thus performed.

In this connection I may mention that on the occasion of my visit to Europe in the summer of 1870 I was honored by the President of the United States with an appointment to represent this country at a meeting of an international commission, invited by the late Emperor of France, to consider the best means of multiplying copies for distribution of the original meter preserved in the archives of the government at Paris. Unfortunately, before the time of meeting arrived, in August, the Franco-German war commenced, preventing the attendance of a number of commissioners who would otherwise have been present. On this account it was resolved to permanently adopt no definite proposition in regard to the meter, but merely to discuss the various questions which might be connected with the general subject. The commission remained in session from the 8th to the 14th of August, and adjourned to meet again at a more favorable season.

The Institution has taken much interest in the historical phenomenon of the movement in Japan in regard to the adoption of western civilization.

A full set of the publications of the Institution has been presented to the University of Yedo, and arrangements made with it for obtaining meteorological observations and specimens of archæology and natural history. A special request was made by the Institution in behalf of the Japanese Minister, Mr. Mori, of the principal publishers of school-books in the United States for such of their publications on education as they might see fit to present for examination to the Japanese commission. In response to this application acknowledgments are due, for liberal donations, to the following publishers: D. Appleton & Co.; A. S. Barnes & Co.; Brewer & Tileston; E. H. Butler & Co.; Claxton, Remsen & Haffelfinger; R. S. Davis & Co.; Eldredge & Bro.; W. S. Fortescue; Harper Bros.; Holt & Williams; Houghton & Co.; Ivison, Blakeman, Taylor & Co.; J. B. Lippincott & Co.; Henry C. Lea; G. & C. Merriam; Murphy & Co.; Oakley, Mason & Co.; J. W. Schermerhorn & Co.; C. Scribner & Co.; Sheldon & Co.; Sower, Barnes & Potts; Thompson, Bigelow & Brown; University Publishing Company; Wilson, Hinkle & Co.; Woolworth, Ainsworth & Co.

While the Smithsonian Institution occupies ground otherwise uncultivated, it has been its policy from the begining to co-operate with all other institutions in advancing science and promoting education. There must always exist objects of importance for the promotion of which appropriations cannot be immediately obtained from Congress, and which, without aid, cannot be properly prosecuted. In England such objects to a limited extent are assisted by funds derived from the subscription list of members of the British Association, and by an annual grant from the government to the Royal Society. These appropriations, though producing important results, are far from being adequate to the solution of problems, the number and variety of which are constantly increasing. When we consider the intimate connection of a knowledge of abstract science with modern civilization, the effect which it has had in substituting the powers of nature for slave labor, in the disc o very of laws a knowledge of which enables man to predict, and in many ca ses to control, the future, it must be evident that nothing can better mark the high intelligence of a people than the facilities which they afford and the means they provide for promoting investigations in this line. It is a matter of surprise, however, that so imperfectly is the importance of abstract science appreciated by the public generally, that unless it be immediately applied to some practical purpose in the arts it is almost entirely disregarded.

NATIONAL MUSEUM.

An appropriation during the last two years has been made by Congress of $20,000 for the reconstruction of parts of the building destroyed by the fire, and the fitting up of rooms for the better accommodation of the National Museum. This sum, together with about $9,000 from the

income of the Smithsonian fund, has been devoted during the past year to this purpose.

With a view to the ultimate separation of the operations of the Smithsonian Institution from the National Museum, arrangements have been made for appropriating the east wing and range to the business which may be considered as belonging exclusively to the essential objects of the Institution, and devoting the main building, west wing, and towers to the museum. For this purpose the large room on the first floor of the east wing, which was formerly used as a museum-laboratory and store-room, has been fitted up with bins and conveniences for assorting and packing the literary and scientific exchanges to be sent to foreign countries. Preparation has also been made for removing the chemical laboratory from the first floor of the east range to the space immediately below it in the basement, and for applying the whole of the first floor of this part of the building to the business offices of the Secretary and his assistants in the line of what are called the active operations.

For the special accommodation of the museum the large room in the west wing, formerly occupied by the library, has been prepared for the reception of cases for mineralogical and geological specimens; while the great hall, 200 feet by 50, in the second story of the main building, has been completed and is now ready to receive the cases for the anthropological and other specimens.

Estimates are now before Congress for fitting up these rooms with cases for the reception and display of the Government collections; and it is hoped that, in the next report, we shall be able to chronicle the commencement, if not the completion, of the work.

The changes consequent upon the extension of the museum mentioned made a re-arrangement necessary of the greater part of the basement so as to obtain additional security against fire, and greater convenience for the storage of fuel, packing-boxes, and specimens. A floor was laid through the basement, and new passage-ways opened, furnishing better access from one extreme of the building to the other. In introducing the fire-proof floor into the west wing, advantage was taken of the opportunity to increase the height of the room below it, and to convert it and the adjoining rooms in the west range into laboratories and store-rooms for natural history.

Furthermore, for better security, the fire-proofing of the floors of the four towers on the corners of the main building has been commenced. The rooms in the towers furnish studies and dormitories for the investigators in the line of natural history who resort to the Institution, especially during the winter, to enjoy the use of the library and the collections for special researches.

The Norman style of architecture adopted for the Smithsonian building produces a picturesque effect, and, on this account, the edifice has been much admired. It is, however, as I have frequently before

remarked, one of the most expensive buildings in proportion to its interior capacity which could have well been devised; expensive not only in its first construction, but also in the repairs which are continually required to protect it from the influence of the weather, which is obvious when the number of projections, towers, and exposed angles is considered.

The building, which from the first has been a drain on the Smithson funds, still requires an appropriation for heating-apparatus, and for annual repairs, which, in justice to the bequest, we trust will be provided by Congress.

For defraying the expenses of the care and exhibition of the National Museum, Congress has annually, for the last two years, appropriated $10,000. Although this appropriation was more than double that of previous years, still it fell short of the actual expenditure. The amount of items chargeable to the museum during the past year, independent of the rent which might have been charged for the rooms occupied, or for repairs of the building, was a little more than $13,000. Deducting from this sum the $10,000 appropriated by Congress, and there remains $3,000, which was paid from the income of the Smithson fund.

A statement of this deficiency has been presented to Congress, and we trust that the sum of $15,000 will be appropriated for the same purpose for the ensuing fiscal year.

By the completion of the large room in the second story and the appropriation of the west wing and connecting range to the same purpose, the space allotted to the museum in the Smithson building has been increased to about threefold. It is proposed, as was stated in the last report, to devote the room in the west wing to specimens of geology and mineralogy, and the large room in the second story to specimens of archæology and palæontology. As preparatory to the fitting up of these rooms, a series of designs has been prepared at the expense of the Institution by B. Waterhouse Hawkins, the well-known restorer of the ancient animals which illustrate the palæontology of the Sydenham Palace, near London.

A commencement has also been made in the furnishing of the large room with casts of some of the larger extinct animals.

The cast of a skeleton of the *Megatherium cuvieri*, generously presented by Professor H. A. Ward, of Rochester, has been set up in the middle of the room. This gigantic fossil was first made known to the scientific world in 1789. It was discovered on the banks of the river Luxan, near the city of Buenos Ayres, and was subsequently transmitted to Madrid. The original bones, of which this specimen is a copy, were found in the same Pampean deposit, between the years 1831 and 1838, and belong partly to the Hunterian Museum of the Royal College of Surgeons, and partly to the British Museum. Cuvier, who gave it its generic title, thought it combined the character of the sloth,

ant-eater, and armadillo. Professor Owen has, however, shown that the *Megatherium* was a "ground-sloth," feeding on the foliage of trees, which it uprooted by its great strength. The extreme length of the mounted skeleton is 17 feet; its height from the pedestal to the top of the spinous process of the first dorsal vertebra is 10 feet 6 inches. The length of the skull is 30 inches; the circumference of the skeleton at the eighth rib is 11 feet.

Also in association with the *Megatherium* a cast has been placed in the same room of the *Colossochelys atlas*, a gigantic tortoise, a restoration from fragments discovered in the Miocene strata of the Sewalik Hills, India, and now in the museum of the Asiatic Society of Bengal. It is 8 feet 2 inches in length by 5 feet 10 in width.

In addition to this, there has been set up a cast of the *Glyptodon*, a representative in Pleistocene times of the armadillos of South America, the original of which was found in 1846, near Montevideo, on the banks of the Luxan. It was presented by order of the Dictator Rosas to Vice-Admiral Dupolet, who gave it to the museum of his native city, Dijon, France, where it is still preserved.

The two last-mentioned specimens were purchased from Professor Ward.

The basis of the national museum is the collection of specimens of the United States exploring expedition under Captain, now Admiral, Wilkes, originally deposited in the Patent Office. It was transferred to the Institution in 1858, and since then has been very much increased by the type specimens from upward of fifty subsequent expeditions of the General Government, and contributions resulting from the operations of the institution. The character of the museum will be properly exhibited for the first time after the various articles are displayed in the new rooms now in preparation for their reception. The museum is especially rich in specimens to illustrate the subject of anthropology; and it is proposed to bring these as far as possible together in the new room in the second story, and to arrange them so as to exhibit their connection and to illustrate the gradual progress of the development of the arts of civilized life.

At present a portion of the large room in the second story is used for the exhibition of the cartoons or original sketches made by the celebrated Indian traveler and explorer Mr. George Catlin. The object of this exhibition is to induce the Government to purchase the whole collection of Indian paintings, including sketches and portraits, the result of the labors of upward of forty years of this enthusiastic and indefatigable student of Indian life. The entire collection, which comprises about twelve hundred paintings and sketches, was offered by Mr. Catlin to the Government in 1846, and its purchase was advocated by Mr. Webster, Mr. Poinsett, General Cass, and other statesmen, as well as by the principal artists and scholars of the country. A report recommending its purchase was made by the Joint Committee on the

Library of Congress, but, owing to the absorption of public attention by the Mexican war, no appropriation was made for the purpose. Mr. Catlin made no further efforts at the time, but exhibited his pictures in Europe, where, on account of an unfortunate speculation into which he was led in London, claims were brought against them which he had not the means to satisfy. At this crisis, fortunately, Mr. Joseph Harrison, of Philadelphia, a gentleman of wealth and patriotism, desiring to save the collection for our country, advanced the means for paying off the claims against the pictures and shipped them to Philadelphia, where they have since remained unredeemed. Mr. Catlin, however, retained possession of the cartoons, and has since enriched them with a large number of illustrations of the ethnology of South America. Whatever may be thought of these paintings from an artistic point of view, they are certainly of great value as faithful representations of the person, features, manners, customs, implements, superstitions, festivals, and everything which relates to the ethnological characteristics of the primitive inhabitants of our country. We think that there is a general public sentiment in favor of granting the moderate appropriation asked for by Mr. Catlin, and we trust that Congress will not fail at the next session to act in accordance with this feeling. It is the only general collection of the kind in existence, and any one who has given thought to the subject cannot but sympathize with Mr. Catlin, who, in his old age and after a life of hard labor and the devotion of all that he possessed in the world to its formation, is now anxious to obtain the means to redeem the portion of his collection retained as security for the payment of claims against him, for the means to enable him to finish the sketches that are still incomplete, and to secure the whole from dispersion through their purchase by the Government.

Respectfully submitted.

JOSEPH HENRY.

WASHINGTON, *January*, 1872.

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Appendix to rep.
1871, p. 42 — for
Entries in record-book,
tion of Specimens, Additions to Col-
lections.

REPORT

OF

PROFESSOR JOSEPH HENRY,

SECRETARY OF THE SMITHSONIAN INSTITUTION,

FOR THE YEAR 1872.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1874.

REPORT OF THE SECRETARY FOR THE YEAR 1872.

To the Board of Regents of the Smithsonian Institution:

GENTLEMEN: The report which I have the honor to present at this time completes the history of the operations of the Smithsonian Institution for the first quarter of a century of its active existence; and as it is important to recapitulate, from time to time, the policy which has been adopted for the management of the funds intrusted to the United States for the good of men by James Smithson, it may be well on this occasion to recall the essential features of the trust, and to briefly state such salient points connected with its administration as may be of especial importance in the future.

At the time the funds were received by the General Government, the distinction between education and original scientific research was not so fully recognized as it is at the present day, and therefore it is not surprising that the brief though comprehensive language in which the will of Smithson was expressed should not have been generally understood, or that the words "I bequeath the whole of my property to the United States of America, to found at Washington, under the name of the Smithsonian Institution, an establishment for the *increase* and *diffusion* of knowledge *among men*," should have been so interpreted as to induce Congress to direct the expenditure of the income of the fund principally to objects which, though important in themselves, did not comport with the strict interpretation of the will, being of a local character instead of affecting the interests of humanity in general.

Smithson devoted his life to abstract science and original research, and there cannot be a reasonable doubt that he used the terms "increase and diffusion of knowledge among men"* to imply that the income of his bequest should be devoted to original research in all branches of knowledge susceptible of increase, and the diffusion of the result of this through the press for the benefit of mankind generally.

* The terms *increase* and *diffusion* of knowledge were used, in the specific sense here indicated, by men of science of the time of Smithson. As an illustration of this we may cite the following remark of William Swainson, a celebrated naturalist. Speaking of the Zoological Society of London, he says: "It is more calculated to *diffuse* than to *increase* the actual stock of scientific knowledge." The author further remarks that, "while we may truly exult in this awakening of the national intellect, we must remember that *diffusion* and *advancement* are two very different processes; and each may exist independent of the other. It is very essential, therefore, to our present purpose, when we speak of the *diffusion* or *extension* of science, that we do not confound these stages of development with *discovery* or *advancement;* since the latter may be as different from the former as depth is from shallowness." (See Cabinet Cyclopedia, Natural History, p. 314, London, 1834.)

The terms of the will, when critically analyzed in their scientific signification, will admit of no other interpretation, and the fitness of the policy which has been adopted after much discussion, and, as far as the original restrictions of Congress would allow, has met with general approval by men of science of all countries.

After having devoted assiduously twenty-five of the best years of my life to the administration of the affairs of the Institution, I may be pardoned for making some personal allusions to the past, and expressing my earnest desire that the same policy which was inaugurated and has been continually observed under my direction may be continued in the future, when I shall have ended my connection with the establishment, with only such modifications as the ever-changing conditions of the world may render necessary.

Immediately after the organization of the Institution, in 1846, I was requested by personal friends in the Board of Regents to give my views as to what the Institution ought to be, in order to realize the intention of the founder as expressed in his will. Having been long impressed with the importance of special provision for original research, and believing it was the intention of the founder of the Smithsonian Institution to offer facilities for this purpose, I suggested the essential features of the programme published in my first report to the Board of Regents in 1847; and, on account of this suggestion I presume, I was informed that if I would accept the position of Secretary, or rather director, of the establishment, I would receive the appointment.

Being at the time engaged in a series of original researches, I did not at first entertain the proposition; but afterward, on the expression of the opinion of the more prominent members of the American Philosophical Society that it was my duty, as the only scientific candidate that had been proposed, to accept the appointment, I accordingly consented, was elected, and entered upon my duty; not, however, without much anxiety and great solicitude as to my ability in the line of administration, but with the hope that the policy which I wished to inaugurate would be readily understood and properly appreciated; that my plans would be immediately adopted; and that, after seeing the Institution fully under way in the direction proposed, I might retire from its charge, return to my former position in the College of New Jersey, and resume my scientific investigations. In this, however, I was sadly disappointed.

The plan proposed was too much in advance of the popular intelligence of the day, both in this country and in England, to be immediately adopted. The value of scientific research had not then received that high appreciation which it enjoys at the present time; and, indeed, no distinction was then made between the popular expounder of scientific principles and the original investigator, to whose labors the world was indebted for important additions to human knowledge.

Opposed to the views of establishing an institution the great feature of

which should be the facilitating of original research, was the organization which had been directed by Congress, namely, that provision should be made on a liberal scale for a museum, a library, a gallery of art, lectures, and an arboretum, involving the construction of a large building, whereas the plan for original research required a building of comparatively small dimensions, the cost of which need not to have exceeded $50,000; while the estimated cost of the one proposed was $250,000, and it has actually cost more than double that sum. It was in vain to urge that the law of Congress might be altered, although the will of Smithson could never be changed. Public opinion apparently was generally in favor of the erection of a large building, and the establishment of a library, museum, gallery of art, and lectures. Still a majority of the Board of Regents were in favor of the plan of original research and publication, and, after much discussion, it was finally agreed, as an experiment, to divide the income into two equal parts, giving one part to what has been called the "active operations," and the other to the library, museum, and other local objects. In the attempt to carry out this division, difficulties occurred which led to its final abandonment, and to the adoption of another arrangement, that of making such provision from time to time for the museum and library and gallery of art as might be thought necessary under existing conditions. As might have been anticipated, the cost of the building far exceeded the original estimate, and the multiplicity of objects was far too great to be sustained by the comparatively small income of the establishment. The increase of the library, by exchanges for the publications of the Institution, itself was so rapid that the care and binding of the books alone absorbed a considerable part of the income.

The collections of natural history and ethnology belonging to the Government were transferred to the care of the Institution, and an allowance of only $4,000 annually made for their support, while, as the number of specimens was continually increasing, the sum allowed by Congress finally scarcely paid more than one-fourth the actual expenses, without estimating the rent and cost of repair of the building. Besides this, Congress had presented to the Institution a portion of the public reservation on which the building is situated. In the planting of this with trees, nearly $10,000 of the Smithson income were expended.

It is readily seen from this statement that with the increase of the library and museum, the formation of a gallery of art, and the sustaining of a public park, all the income would be absorbed, and the cherished plan of an institution to facilitate original research, and the publication of its results, must be abandoned.

To prevent so undesirable a result, advantage was taken of the exposure of the books after the fire, to urge the plan of uniting the library of the Institution with that of Congress, and of the two to form a collection worthy the name of National Library. The proposition was adopted, and the results have proved eminently successful. The Library of Con-

gress is now the largest in the United States, the scientific part of which is rapidly becoming, through the Smithsonian exchanges, one of the best of the kind in the world. Furthermore, Congress is now about to erect a separate building for its accommodation.

Previous to this union of the libraries, however, an appropriation had been made by Congress for improving the public ground between the Potomac and the Capitol. Advantage was taken of this to include the Smithsonian portion of these grounds in the general plan, and thus to relieve the Institution from the cost of its maintenance.

The remaining drains upon the income, which continued to diminish the active operations, were the care of the building and the maintenance of the museum; and the next step, therefore, was to induce Congess to relieve the Institution from these. The results, in the mean time, of the active operations having signally demonstrated the importance of original research and publications, together with the general system of exchanges which had been adopted, Congress finally lent a favorable ear to the petition for appropriations sufficient to support the museum, and now annually appropriates $15,000 to this purpose.

In justice to the trust, however, the Government ought to do much more than this. It should repay at least a portion of the $600,000 which have been expended on the building, erected in accordance with the instruction of Congress, and far exceeding in cost an edifice wanted for the legitimate objects of the Institution. The proper course to adopt would be for Congress to take entire possession of the building for the National Museum, repay the Smithson fund, say $300,000, adding $200,000 of this to the principal of the trust-fund, and applying the remainder to the erection of a separate building, consisting of offices, laboratories, store-rooms, &c., required for the present use of the Institution.

The only other requirement of Congress which has not been fully met is that of a gallery of art. It is true the Institution owns a very valuable collection of specimens of the early masters to illustrate the progress of the art of engraving, and some articles of painting and sculpture, which may be considered as forming the commencement of a gallery of art; but the expense of supporting a collection of this kind has been obviated by the establishment in this city of a gallery of art by the liberality of Mr. W. W. Corcoran, with an income larger than all of that from the Smithson fund.

Notwithstanding the various burdens which have interfered with the full development of the plan of active operations, it is through this plan that the Institution has made itself known throughout every part of the civilized world. The publications which result from the facilities it has afforded to original research are to be found in all the principal libraries, and its specimens in all the great public museums of the world. And it is hoped that in future, with the appropriations of Con-

gress for the support of the museum, still more important results will be obtained.

The success of the plan for realizing the intentions of Smithson for increasing and diffusing knowledge among men has been due to its simplicity and efficiency. Under a Board of Regents, which holds its sessions once a year, the operations of the establishment are directed by a single individual, called the Secretary, who, with the consent of the Regents, employs assistants and disburses the income of the fund. In determining the appropriations to different objects of research, the advice of persons of established reputation in different branches of science is obtained, and in all cases, before an article is accepted for publication, it is submitted to a commission of experts, who report upon its fitness for adoption by the Institution. In order to obtain a free and unbiased judgment, the name of the author, as far as possible, is concealed from the examiners, and the names of the latter are unknown to the former. By adopting this course the Institution secures the co-operation of the best minds of the country, and in some cases has called in the aid of foreign *savans*. It is gratifying to be able to state that in no instance has aid of this kind been declined. In this way the greatest amount of mental labor is secured with a given expenditure of funds. It is true the plan might have been adopted of electing men of original research in the various branches of science, and supporting them entirely on the funds of the establishment; but the income was not sufficient for this purpose, as will be evident when the fact is considered that the will includes all branches of knowledge, and that every subject susceptible of increase is entitled to the benefit of the funds. At the beginning, however, since Congress directed the formation of a library and a museum, it was necessary that the Secretary should have assistants to take especial charge of these two branches of the establishment. With the transfer of the library to the care of the Government, a librarian of the Institution has been dispensed with; but since the museum is still under the care of the Institution, an assistant in charge of this is still required, and Professor Baird, who has acted as assistant secretary, has had charge of the museum, and has rendered important service, not only in the line of natural history, but in that of the general operations of the establishment.

The greatest opposition to the plan of active operations was made by the friends of the establishment of a library, but they have finally acquiesced in the propriety of the course which has been pursued. The number of books of the first class which the Institution is bringing into the country through its system of exchange, and which are distributed to all the large cities of the United States, more than compensates for the support of a restricted library in the city of Washington by the funds of the Institution.

The plan in regard to the museum was also at first misunderstood. It was supposed that because the Secretary opposed the establishment

of a museum at the expense of the Institution that he was not well disposed toward the advance of natural history. But this misapprehension can readily be removed by the consideration that natural history could be much more effectually advanced by expending less than a moiety of the cost of the building for the museum and the support of the collections, in original explorations, in collecting specimens not to be preserved, but to be distributed to all who might have the desire and ability to investigate special problems in this branch of knowledge. The policy in regard to natural history is that of making collections of large numbers of duplicate specimens to illustrate the natural productions of North America, to make these up into sets, reserving one for the National Museum, and distributing all the others for scientific and educational purposes to the museums of the world. In every case in which application has been made to the Institution by an original investigator from any part of the world for specimens connected with his researches, they have been sent to him as far as possible, assurance being given that the specimens would be properly used and full credit given to the name of Smithson. As the specimens are collected, as a general rule, they are submitted to specialists in the various branches of natural history, who, without charge, classify, arrange, and label them for distribution. In this way the Institution has done much for natural history; but it is evident that it could have done much more had it not been obliged to support a public museum at the expense of several hundred thousand dollars for an edifice for this purpose.

One prominent maxim of the Institution has been "co-operation not monopoly," and another, "in all cases, as far as possible, not to occupy ground especially cultivated by other establishments," or, in other words, not to expend the money of the bequest in doing that for which provision could be obtained through other means. To gratify men of literature as well as to advance an important branch of knowledge, from the first much attention has been given to anthropology, including linguistics, antiquities, and everything which tends to reconstruct the history of man in the past; this being a common ground on which the man of letters and of science could meet as harmonious collaborators.

From the foregoing sketch it will be evident that the theory of the Institution is that of an ideal establishment for the collection of facts, the elaboration of these into general principles, and a diffusion of the results among men of every race and of every clime. That an institution of this character, in which the accumulation of ideas and not merely of material objects is the great end, should not have been properly appreciated at first in a country so eminently practical as ours is not surprising. But we are happy in knowing it has been from year to year growing in public estimation, and we are encouraged to cherish the belief that it will not only realize the ideas of the benevolent founder of the Institution, but also serve as an example of imitation, while the

errors which may have been committed will also be of service in an opposite way.

There is one feature of the establishment ordained by Congress which is worthy of imitation in the conduct of all endowments for benevolent objects, namely, the restriction of all expenditures to the annual interest. This rule has been rigorously adhered to in the conduct of the Institution, and after expending, in accordance with the act of Congress, upward of $600,000 on the buildings, the original fund remains intact with an addition made to it of upward of $150,000 by savings, judicious investments, &c.

FINANCES.

The following is a general statement of the condition of the funds at the beginning of the year 1873:

The amount originally received as the bequest of James Smithson, of England, deposited in the Treasury of the United States, in accordance with the act of Congress of August 10, 1846	$515,169 00
The residuary legacy of Smithson, received in 1865, deposited in the Treasury of the United States, in accordance with the act of Congress of February 8, 1867	26,210 63
Total bequest of Smithson	541,379 63
Amount deposited in the Treasury of the United States, as authorized by act of Congress of February 8, 1867, as derived from savings of income and increase in value of investments	108,620 37
Total permanent Smithson fund in the Treasury of the United States, bearing interest at 6 per cent., payable semi-annually in gold	650,000 00
In addition, there remains of the extra fund from savings, &c., in Virginia bonds, at par, $88,125.20, now valued at	37,000 00
The balance in First National Bank 1st of January, 1873	17,811 30
Total Smithson funds 1st January, 1873	704,811 30
The income of the Smithson fund during the year, including premium on gold, was	46,916 45
The expenditures were	45,420 11
Leaving a balance of	1,496 34

To be added to the balance at the beginning of the year 1872.

Included in the income was $3,004.90 derived from back interest on the Virginia bonds. The value of these bonds has appreciated during the year.

PUBLICATIONS.

The publications of the Institution are of three classes—the Contributions to Knowledge, the Miscellaneous Collections, and the Annual Reports. The first consist of memoirs containing positive additions to science resting on original research, and which are generally the result of investigations to which the Institution has in some way rendered assistance, or of such an expensive character as cannot otherwise be published. The Miscellaneous Collections are composed of works intended to facilitate the study of branches of natural history, meteorology, &c., and are designed especially to induce individuals to engage in studies as specialties. The Annual Reports, beside an account of the operations, expenditures, and condition of the Institution, contain translations from works not generally accessible to American students, reports of lectures, extracts from correspondence, &c.

The following are the rules which have been adopted for the distribution of these publications:

1st. They are presented to learned societies of the first class which in return give complete series of their publications to the Institution.

2d. To libraries of the first class which give in exchange their catalogues and other publications, or an equivalent, from their duplicate volumes.

3d. To colleges of the first class which furnish meteorological observations, catalogues of their libraries and of their students, and all other publications relative to their organization and history.

4th. To States and Territories, provided they give in return copies of all documents published under their authority.

5th. To public libraries in this country, not included in any of the foregoing classes, containing 15,000 volumes, especially if no other copies are given in the same place, and to smaller libraries where a large district would be otherwise unsupplied.

6th. To institutions devoted exclusively to the promotion of particular branches of knowledge are given such of the publications as relate to their respective objects.

7th. The Reports are presented to the meteorological observers, to contributors of valuable material to the library or collections, and to persons engaged in special scientific research.

The distribution of the publications of the Institution is a matter which requires much care and a judicious selection of recipients, the great object being to make known to the world the truths which may result from the expenditure of the Smithson fund. For this purpose, the principal class of publications, namely, the Contributions, are so distributed as to be accessible to the greatest number of readers, and this is evidently to principal libraries.

The volumes of Contributions are presented on the express condition that while they are to be carefully preserved they are to be accessible to

students and others who may desire to consult them. These works, it must be recollected, are not of a popular character, but require profound study to fully understand them. They are, however, of immense importance to the teacher and the popular expounder of science. They contain the materials from which general treatises on special subjects are elaborated.

Full sets of the publications cannot be given to all who apply for them, since this will be impossible with the limited income of the Institution; and, indeed, if care be not exercised in the distribution, so large a portion of the income will be annually expended on the distribution of what has already been printed that nothing further can be done in the way of new publications. It must be recollected that every addition to the list of distribution not only involves the giving of publications which have already been made but also of those which are to be made hereafter.

At the commencement of the operations of the Institution the publications were not stereotyped, and consequently the earlier volumes have now become scarce, especially the *first*, of which there are no copies for distribution, although it can occasionally be obtained at a second-hand book-store in some of the larger cities, the authors having been allowed to strike off an edition to sell on their own account.

No copyright has ever been taken for any of the publications of the Institution. They are left free to be used by the compiler of books without any restrictions except the one that full credit shall be given to the name of Smithson for any extracts which may be made from them.

The printing of the publications of the Institution almost since the organization has been principally done at Philadelphia, by the house of T. K. Collins, under the superintendence of Mr. J. W. Huff, whose accuracy and typographical skill leave us nothing to desire in this line. The stereotype plates are all deposited in the fire-proof vault of the basement of the Academy of Natural Science, Philadelphia; and to this society the Institution has been indebted many years for the courtesy of storing, free of cost, this valuable property.

Publications in 1872.—During the past year the volume of Tables and Results of the Precipitation in *Rain* and *Snow* in the United States and at some stations in adjacent parts of North America, Central and South America, has been printed and partly distributed. It consists of 178 quarto pages, with five plates and three charts. It contains the abstracts of all the records of observations of the rain-fall which have been made from the early settlement of this country down to the close of the year 1866, so far as they could be obtained. These records are from about twelve hundred stations, and consist of the observations made under the direction of the Institution, assisted since 1854 by the Patent-Office and Department of Agriculture, of those of the Medical Department of the United States Army, of those by the United States Survey of the North and Northwest Lakes, of those made by the New York University system, by the Franklin Institute in Philadelphia, and also of those by

other scientific institutions and individuals. During the past year the compilers have completed the tables of rain for 600 Smithsonian stations for the years 1868, 1869, and 1870, and of 220 military posts from December, 1864, to November, 1871. The result of all the observations has been incorporated in the charts published in 1872, but the tables will be combined with those already published at some future time.

It is proper here to express our obligations for the valuable co-operation of the Medical Department of the Army, under Surgeon-General Barnes, who has given us free access to all the unpublished records; and also for that of the Department of Agriculture, under its former commissioner, General Capron. These tables furnish the means for important deductions intimately connected with the agriculture, commerce, and mechanical industry of the country, while they constitute a valuable contribution to the physical geography of the globe.

This memoir is one of a series embodying the results of all the labors of the Smithsonian Institution in regard to the meteorology of the United States. These will include not only all the observations which have been made under its own direction, but also the discussion of all that has been made by other parties. The whole series will embrace the tabulation and discussion of observations on the temperature, atmospheric pressure, direction and force of the wind, moisture of the air, and miscellaneous phenomena.

Another work, that of Dr. Horatio C. Wood, jr., of Philadelphia, on the *fresh-water algæ*, was briefly noticed in the report for 1870. It forms a complement to the great work on the marine algæ by Dr. Harvey, published in 1858 by the Smithsonian Institution. It is illustrated by numerous drawings, made principally under the microscope, and will serve to illustrate an obscure department of botany, and also to furnish the means by which investigators of minute microscopical organisms may compare recent and fossil forms. The work was presented to the American Philosophical Society and also to the Academy of Natural Sciences of Philadelphia, but the expense of the engravings prevented either of these societies from undertaking its publication, although it was considered entirely worthy of their adoption. It was referred by the Institution to Dr. Torrey and Professor Barnard for critical examination, and published on their recommendation.

A large part of the material for this work was gathered by Dr. Wood himself, although he was indebted to several persons for aid, especially to Dr. J. S. Billings, of the United States Army, for collections made near Washington; to Professor Ravenel, of South Carolina, for collections in Texas, South Carolina, and Georgia; to Mr. C. J. Austin for specimens gathered in Northern New Jersey; to Mr. William Canby for collections obtained in Florida; to Professor Sereno Watson for others from the Rocky Mountains; and to Dr. Lewis for specimens from the White Mountains. The work embraces all families

of the fresh-water algæ except the diatomaceæ, which are so numerous as to constitute in themselves a special object of study.

The synonomy of Professor Rabenhorst has been generally followed, this naturalist having gone over the subject most thoroughly, with full access to all its literature. "To attempt to differ from him," says Dr. Wood, "would cause endless confusion. I have therefore nearly always contented myself with his dictum, and have referred to him as authority for the names adopted." The memoir in question consists of 272 pages, and is illustrated by 21 quarto-plates of a very expensive character, since they required in most cases a number of printings to produce the different colors.

Another investigation to the prosecution of which the Institution has contributed is that by Mr. William Ferrel relative to the *tides*. To this subject the author has given much attention, and has completed a memoir in regard to it, which is now in the press. This memoir does not purport to be a regular treatise on the tidal theory, but is for the most part supplementary to what has already been done. It does not, therefore, include elementary principles, but pertains principally to those parts of the general theory in which new results are attainable or old ones susceptible of being presented in a more concise and simple manner. For the author's purpose, however, it was necessary to go over much of the ground which had been investigated; but all those parts of the subject which had already been well treated are passed over with a mere reference as to where they might be found. At the time when this subject was treated by La Place, Young, and Airy, but few observations had been made and little attention had been given to the accurate comparison of the results of observation with those of theory, or to the formation of tables for the purpose of predicting the time of the phases of the tides. For accomplishing the result it is necessary to obtain not only an accurate development of the solar and lunar disturbing forces, but also to determine the expressions which shall represent most accurately the tidal relations to any one part of the whole of these disturbing forces. "Every investigator of the tides," says the author, "must frequently have felt the great need of formulæ of this kind prepared to his hand, which he could use and thus save the labor of difficult developments and accurate determinations of co-efficients in special cases." This great need the author has attempted to supply.

Believing that most of the hitherto unexplained apparent anomalies in the tides are due to the friction of the water on the surface of the earth, the author has given special attention to the effects of this in all the various cases, not only on the hypothesis of its being in direct proportion to the velocity but also as the square of the velocity. The results obtained in this part of the investigation are regarded as being interesting and important in relation to some of the phenomena of the tides which have not hitherto been explained, especially to the occurrence

of the greatest tides in the Atlantic one or two days after the time of the greatest force. A correct tidal theory should furnish the data for a determination of the moon's mass; and this determination should be the same for every port. Considering this as one of the best tests of any tidal theory, the author has given much attention to framing various equations from theory for this purpose, and to their application to the results of tidal observations at various ports. The comparisons are made with the extended series of observations of the United States Coast Survey and with the results obtained by the Tidal Committee of the British Association from the analysis of tidal observations of various ports by means of the harmonic method of analysis. The memoir also contains the discussion of the published series of observations of the French government at Brest, with a comparison of the results with theory, and a chapter on the retardation of the earth's rotation on account of the tides, and its effect upon the apparent secular variation of the moon's motion in its orbit.

Beside the labor expended on this memoir in the line of higher mathematics, it involves arithmetical computations of a very laborious character, the expense of which will be defrayed by the Institution.

The investigation of the orbit of Uranus, by Prof. S. Newcomb, of the National Observatory, was substantially completed in October last, and has since been entirely prepared for the press, with the exception of some final revision. Considerable additions and alterations are, however, still required in the appended tables, to be used for computing ephemerides of the planet; but these the author hopes to complete in a few months, so that the work may be put in the hands of the printer early in 1873.

This work, on which the author has been engaged for thirteen years, has absorbed the greater part of his leisure time from his duties in the National Observatory during the last five years. Its preparation not only involved abstruse mathematical discussions, but also arithmetical calculations of very great extent. The latter were made at the expense of the Institution; and through the assistance thus rendered, Professor Newcomb has been enabled to complete his important investigations without devoting his energies to labors which could be well performed by intelligence of a less valuable character.

The following remarks by the author of this work may here be considered in place:

"It will perhaps surprise those not especially devoted to astronomy to learn that, although the planet Neptune has been known for a quarter of a century, the positions of Uranus in all the astronomical ephemerides of Europe are still computed, without regard to the action of that body, from the old tables of Bouvard, dating back as far as 1820, the errors of which led to the discovery of Neptune in 1846. A result of this was that an occultation of Uranus by the moon, which occurred

in 1871, was erroneously predicted by the Nautical Almanac to the extent of some six minutes, and in consequence a number of observers who were on the alert to see so rare a phenomenon missed it entirely. An outcry was raised against the almanac in consequence, but it was met by the remark that that work could use only such tables as were at its disposal, and that the construction of new ones corresponding to the present state of astronomy was now almost beyond the power of any individual, and could only be undertaken under the auspices of some sufficiently liberal government.

"The disinclination of astronomers to undertake such a work as this may be illustrated by the fact that the tables of Jupiter and Saturn, as well as those of Uranus, are more than fifty years old, and are, of course, considerably in error. The Astronomical Society of Germany has been engaged in preparing the data for new tables of Jupiter during the past five years, but I am not aware of any recent report of progress.

"The first chapter of the work gives an exposition of the method employed in calculating the action of the disturbing planets Jupiter, Saturn, and Neptune on the motion of Uranus. In the second chapter this method is illustrated by quite a detailed calculation of the perturbations of Uranus produced by Saturn, including, however, only those which are of the first order with respect to the disturbing force. In the third, the perturbations produced by Jupiter and Neptune are given, but the computations are not presented with the same detail. The fourth chapter opens with a preliminary investigation of the orbit of Saturn, using Hansen's perturbations and the Greenwich observations, the object being the accurate determination of the terms of the second order. This is followed by the computation of the terms of the second order produced by Saturn, which include those containing as a factor either the square of the mass of that planet, or the product of its mass by that of Jupiter or by that of Uranus. The most remarkable of these terms is one of very long period, in which the results differ materially from those of other authorities, including Le Verrier, Delaunay, Adams, and Hansen, who all agree among themselves. I cannot find any error in my work, and so must, of course, retain my own result, leaving it to future investigators to find the cause of the discrepancy. The difference is of such a nature that it cannot affect the computed position of the planet until after the lapse of more than a century.

"The sixth chapter gives a discussion of all the observations of Uranus which have been published and reduced in such a manner as to be made use of. The entire number is 3,763. The correction to a provisional theory given by each series of observations is deduced.

"The object of the seventh chapter is to apply such corrections to the elements of Uranus and the mass of Neptune that the observations shall be represented with the smallest possible outstanding errors. The mass of Neptune comes out $\frac{1}{19706}$, almost exactly the same as that found by Professor Peirce more than twenty years ago.

"The representation of the observations by the concluded theory will probably be regarded as good. The mean outstanding difference during each five years since the discovery of the planet only exceeds a second of arc in a single instance, namely, during the years 1822–'26, when it amounts to 1″.4. This agreement is very much better than any obtained before. Still the vast number of observations used, and the care taken to reduce them to a uniform standard, led me to believe a better representation possible; and the outstanding differences, minute though they be, follow a regular law, thus showing that they do not arise from the purely accidental errors of observation. How far they arise from errors in my own theoretical computations, how far from the reductions of the observations themselves, and how far from the unavoidable errors of the instruments, I am unable to say without further investigation. It would be desirable to learn whether they may be due to the action of a trans-Neptunian planet, but to do this would require an entire re-reduction of all the older observations. Such a work is on many accounts an astronomical desideratum, but it could not be undertaken except under the auspices of the Government.

"In the eighth chapter the general formulæ and elements are collected and expressed in the form most convenient for permanent use.

"The ninth and concluding chapter gives tables by which the position of the planet may be computed for any time between the Christian era and the year 2300."

It has been mentioned in several of the reports that the Institution has collected large numbers of vocabularies of the several Indian languages of North America, including those of the Indian tribes of Washington Territory, California, northwest coast, New Mexico, Arizona, and the prairies; that these had been placed in the hands of Mr. George Gibbs for critical study and revision; and that, after consultation with some of the principal philologists of the country, it had been concluded to publish them, as it were provisionally, as material for ethnological and linguistic investigations. During the past year Mr. Gibbs has devoted considerable time to the arrangement of these vocabularies, and has completed the preparation for the press of one of the sets, namely, that of the Selish language, which is now in the hands of the printer.*

In order to facilitate the re-arrangement of the collections of the National Museum, the Institution has requested experts in the various branches of zoology to prepare catalogues exhibiting the best arrangements of the several classes of the animal kingdom; the families, in each case, to be numbered in successive order, and the subfamilies to be indicated by letters, thus: "15, Canidæ; (15) *a*, Caninæ; (15) *b*, Megalotinæ," &c. It is intended that these numbers and letters shall be

* Since the presentation of this report, the work in question has been stopped by the death of Mr. Gibbs, one of the most esteemed collaborators of the Institution.

attached to the specimens or receptacles containing them, and thus the agency of an ordinary laborer, or one unconversant with the animals, can be utilized in sending for specimens, replacing them, and revising the collections.

In accordance with the requests made, Professor Gill has prepared three catalogues, one on the arrangement of the families of mollusks, referred to in previous reports; another on the arrangement of the families of mammals; and a third on the arrangement of the families of fishes. The last two were published in November, 1872.

The "arrangement of the families of mammals" embraces a list of the recent as well as extinct families and subfamilies of the class. Of these, 136 are recognized. These are combined under fourteen orders and three subclasses, the subclasses being those almost universally recognized at the present time—monodelphia, didelphia, and ornithodelphia. The orders of monodelphia have been segregated into two higher divisions, or "super-orders," equivalent to the educabilia and ineducabilia of Prince Bonaparte, but with other characters derived from the interior structure of the brain; the educabilia correspond with the archencephala and gyrencephala of Owen combined, and the ineducabilia to the lissencephala.

"Synoptical tables of characters of the subdivisions of mammals, with a catalogue of the genera," have been in part published in connection with and under cover of the arrangement of the families of mammals, embracing pages 43 to 98 of that work; only that portion embracing the orders of educabilia has been completed, the remaining portion having been necessarily deferred. In contrasted dichotomous tables are given characters successively of the (1) subclasses, (2) the orders of monodelphia, and (3) the suborders, (4) families, and (5) subfamilies of each group of the educabilian monodelphia. The "arrangement of the families of fishes" is limited to an enumeration of the surviving families of the class, and was especially prepared for immediate use. The group of "fishes" is considered as an artificial combination, and is divided into three classes—fishes proper, marsipobranchiates, and leptocardians. The three classes contain 244 families, of which the true fishes embrace 240; the marsipobranchiates, 3; and the leptocardians, only 1. The families of the fishes proper are combined under eighteen orders and three subclasses; the teleostein ganoidei and elasmobranchii differing in this last respect from Müller's—the most generally accepted—classification simply in the union of the ganoids and dipnoans. The greatest deviation from the current classifications is the constitution of the order teleocephali. In an extended introduction the reasons are given for the modifications suggested.

A large demand has been made for these catalogues for the arrangement of other museums and collections.

It was mentioned in the last report that a new edition of the List of

Foreign Correspondents of the Institution was in press. This work, containing all the later additions to the list, has been published, and is now in use by the Institution and its correspondents.

It was also stated that a List of the Scientific, Educational, and Literary Establishments in the United States was in press. This work, which was prepared by Mr. W. J. Rhees, the chief clerk of the Institution, has been published, and is of much service in the distribution of the publications of the Institution, as well as those of the different Departments of Government, and of educational establishments, and will be of assistance to members of Congress in the distribution of documents. It includes 8,575 titles of societies, libraries, &c., as follows:

Colleges, male and female, (so-called)	758
Academies, normal and high-schools	2,850
Law schools and libraries	53
Medical schools and libraries	221
Theological schools and libraries	127
Observatories	23
Scientific societies and libraries	94
Agricultural societies	1,082
Libraries, general	2,692
Asylums and hospitals	491
Asylums for insane	65
Asylums for deaf and dumb	38
Asylums for blind	30
Prisons having libraries	51

For the purpose of forming a general hypsometrical map of the North American continent and for collecting together, for permanent record and publication, the data on which such a map should be based, letters of request have been sent out in every direction likely to be available for such information, while the printed reports of the various governmental, military, and geological expeditions and of railroad and canal surveys have been consulted and made to render tribute. The whole of this work has been placed in charge of the topographer of the Post-Office Department, Mr. Walter L. Nicholson, who reports in regard to it as follows:

"Contributions, in manuscript, have been received from 312 engineers and other officers of railroad companies, furnishing a large body of valuable facts, which, with the heights shown on upward of 70 graphic profiles collected, give upward of 16,000 points more or less accurately determined, over the several States and Territories.

But great labor and perplexity have arisen from the discrepancies found to exist among many of the statements given, owing, chiefly, to the various planes of reference used in the surveys, and to the indefiniteness in their references; and great difficulty has been experienced

in co-ordinating the items so as to refer them all to a common base, the mean level of the sea, while another source of incoherence remains from the non-return of answers from numerous railroad corporations, which have been applied to with all possible courtesy and with expression as to the value of the results sought. Unfortunately, many corporations and engineers have lost or taken no pains to preserve the record of their surveys.

These collections of heights have been copied in twenty-five quarto-volumes, for preservation and convenience in collation. The heights are arranged under the names of places alphabetically, under the headings of the individual States, &c., for convenience of reference when published—giving county, specification of locality, and authority, with notes where required.

This large mass of material is, in greater part, copied in manuscript directly from the returns—the individual names to be finally cut off in slips and arranged alphabetically for printing. While this is being proceeded with, a map has been projected, to represent the mean results of these data, on a scale of five-millionth, size of map 52 inches by 39 inches, which will embrace the large area from 15° to 58° latitude, and, from east to west will take in Newfoundland, the Bermudas, the larger West India Islands, (to St. Thomas,) and on the northwest coast, Vancouver's Island and Queen Charlotte's Island, extending thus well up into Hudson's Bay and down to Central America."

This work will form the basis of a physical map, and will be useful for many purposes of reference other than that of hypsometry.

The report of the Institution for the year 1871 was presented to Congress, and ordered to be printed. A resolution was offered as usual ordering an extra number of copies; and the House of Representatives directed an edition of 20,000 copies. This number was reduced in the Senate to 12,500, and unfortunately, before an arrangement satisfactory to both branches of Congress could be made, the adjournment took place. Up to this time, however, no further action has been taken, and the Institution is still without extra copies for distribution.

As an offset to this disappointment, we are gratified to be able to state that a resolution passed Congress at the last session, directing that an edition of 2,000 copies of all the reports of which there were stereotype plates be printed for the use of the Institution for distribution to public libraries and especially to colleges and higher academies. The series of eight volumes thus reproduced includes the reports from the years 1863 to 1870, inclusive.

We doubt not that Congress before the close of the present session will order the Public Printer to strike off the usual number of copies from the stereotype plates of the report of 1871, and that we shall thus be enabled to gratify in some measure the increasing calls upon the Institution for copies of this document.

In addition to the report of the Secretary, giving an account of the operations, expenditures, &c., of the Institution, and the proceedings of the Board of Regents to the 4th of April, 1872, the report for 1871 contains a memoir of Sir John Frederic William Herschel, by N. S. Dodge, esq.; a eulogy on Joseph Fourier, by Arago; an account of Prof. Thomas Graham's scientific work, by William Odling; translations from the German of a lecture on the relation of the physical sciences to science in general, by Dr. Helmholtz; a lecture on alternate generation and parthenogenesis in the animal kingdom, by Dr. G. A. Kornhuber; a lecture on the present state of our knowledge of cryptogamous plants, by Henry William Reichardt; an original paper on the secular variations of the planetary orbits, by John N. Stockwell, being an abstract of the elaborate memoir published by the Institution in the Contributions to Knowledge; an original article on methods of interpolation applicable to the graduation of irregular series, such as tables of mortality, &c., by E. L. DeForest; a translation of the transactions of the Society of Physics and Natural History of Geneva from June, 1870, to June, 1871; the scientific instructions to Captain Hall's north polar expedition; together with a large number of articles on ethnology and meteorology.

EXCHANGES.

The labors of the Institution in promoting literary and scientific intercourse between this country and other parts of the world have been continued during the past year. The system of international exchanges includes not only all the principal libraries and important societies, but also a considerable number of the minor institutions of Europe. The following table exhibits the number of establishments in each country with which the Smithsonian is at present in correspondence:

Sweden	20
Norway	22
Iceland	2
Denmark	27
Russia	155
Holland	62
Germany	588
Switzerland	63
Belgium	105
France	229
Italy	156
Portugal	20
Spain	11
Great Britain and Ireland	336
Greece	7
Turkey	11
Africa	19

Asia	36
Australia	26
New Zealand	13
Polynesia	1
South America	36
West Indies	7
Mexico	9
Central America	2
British America	18
General	4
Total	1,985

As in previous years, the Institution has received important aid from various steamer and railroad lines in the way of free freights, without which the expense of carrying on the system would be far beyond the means at command. Acknowledgment is again due for the liberality of the following companies:

Pacific Mail Steamship Company.
Panama Railroad Company.
Pacific Steam Navigation Company.
New York and Mexico Steamship Company.
New York and Brazil Steamship Company.
North German Lloyd's Steamship Company.
Hamburg American Packet Company.
French Transatlantic Company.
North Baltic Lloyd's Steamship Company.
Inman Steamship Company.
Cunard Steamship Company.
Anchor Steamship Company.

The Adams Express Company also continues its liberal policy in regard to freight for the Institution.

During the year 2,561 packages, containing many thousand different articles, were transmitted to foreign countries. These packages filled 159 large boxes, having a cubical content of 954 feet, and weighing 26,850 pounds. The parcels received at the Institution for parties in this country, in addition to those for the Smithsonian library, numbered 4,635.

It was mentioned in the last report that the advantages which result from the system of international exchanges had become so apparent that arrangements similar to those adopted by the Smithsonian Institution are beginning to be introduced into different parts of Europe, and that a central scientific bureau for the Netherlands had been established at Amsterdam to receive and transmit packages for different parts of the world, and in the United States to co-operate with the Smithsonian Institution. A similar arrangement has been proposed in

Brussels, by which the Belgian Academy will become a center of scientific exchanges.

During the past year we have received as usual, from persons abroad, copies of works to be distributed gratuitously to institutions and individuals in this country.

The following are the regulations which are to be observed by parties availing themselves of the privilege of the Smithsonian system of exchange:

"The Smithsonian Institution receives parcels at any time with assurance of speedy delivery, at least to the more important addresses, upon the following conditions, which must be strictly observed:

"1. Every package without exception must be enveloped in strong paper, and secured so as to bear separate transportation by express or otherwise.

"2. The address of the institution or individual for whom the parcel is intended must be written legibly on the package, and the name of the sender must be written in one corner.

"3. No single package must exceed the half of a cubic foot in bulk.

"4. A detailed list of addresses of all the parcels sent, with their contents, must accompany them.

"5. No letter or other communication can be allowed in the parcel, excepting such as relates exclusively to the contents of the package.

"6. All packages must be delivered in Washington free of freight and other expenses.

"Unless all these conditions are complied with, the parcels will not be forwarded from the Institution, and, on the failure to comply with the first and second conditions, will be returned to the sender for correction.

"The Institution recommends that every parcel shall contain a blank acknowledgment, to be signed by the recipient and returned, either through the agent of the Institution, or, what is still better, direct by mail, to the sender. Should exchanges be desired for what is sent, the fact should also be explicitly stated on the accompanying circular. Much disappointment has often been expressed at the absence of any return in kind for transmissions; but unless these are specifically asked for they will frequently fail to be made. It will facilitate the labors of the Institution greatly if the number corresponding to the several addresses in the Smithsonian printed catalogue be marked on the face of each parcel; and for this purpose a copy of the work will be forwarded to all who apply for it.

"Specimens of natural history will not be received for transmission, unless with a previous understanding as to their character and bulk."

LIBRARY.

It was stated in the last report that the accessions to the library during 1871 had not been as large as they were the year before, on account

of the war in Europe. In 1870 the whole number of books, &c., received was 5,182; in 1871, 4,597; while during 1872 it has been 5,962, as will be seen from the following detailed statement of the books, maps, and charts received by exchange in 1872:

Volumes:		
Octavo or less	975	
Quarto or larger	287	
		1,262
Parts of volumes:		
Octavo or less	1,371	
Quarto or larger	1,250	
		2,621
Pamphlets:		
Octavo or less	1,557	
Quarto or larger	324	
		1,881
Maps and charts		198
Total receipts		5,962

The following are some of the principal donations received in 1872:

From the Commission européenne du Danube, Galatz—"Mémoire sur les travaux d'amélioration exécutés aux embouchures du Danube." with an atlas of 40 plates.

From A. W. Franks, esq., London—"Catalogue of the Collection of Glass," formed by Felix Slade. London, 1871. Folio. Beautifully illustrated.

From the Observatorio do Infante D. Luiz, Lisbon—"Annals." Vols. iii–viii, 1866–1870. Folio.

From the Institut de France, Paris—"Mémoires de l'Académie des sciences." Vols. xxxvi, xxxvii. 4to. "Comptes-rendus." Vols. lxviii–lxx. "Tables Générale," 1851–1865. 4to.

From Dr. K. Keck, Berlin, 203 pamphlets—University Theses.

From the University of Tübingen—"Repertorium morale." Vols. i–iii. 1489. Folio. "Universitätsschriften," 1870; and 18 pamphlets.

From the Universities of Bonn, Erlangen, Giessen, Göttingen, Greifswald, Halle, Heidelberg, Jena, Leipzig, Marburg, Pesth, Bern, Zürich, and Havana—Inaugural Dissertations for 1871.

From the Royal Veterinary Academy, Utrecht—47 pamphlets.

From the University and Government of Chili, Santiago—10 volumes and 2 pamphlets.

From the Public Library of Buenos Ayres—151 volumes, 334 parts of volumes and pamphlets, and 7 charts.

From the Hungarian Academy of Sciences, Pesth—9 volumes and 33 parts of volumes.

From the Royal Public Library, Stuttgart—26 volumes and 11 parts.

From the Hydrographic Department of the Ministry of Marine, St. Petersburg—57 charts, 16 volumes, and 9 parts.

From the Royal Academy of Sciences, &c., Rouen—"Mémoire sur le Commission maritime de Rouen," vols. i and ii; and "Précis analytique," 1804–1870, 14 volumes.

From the Ohio State Library, Columbus—13 volumes and 5 charts.

Among the donations there are two which deserve especial notice, namely, the memoir upon the works which have been executed for the improvement of the mouth of the Danube, and the fac-similes of the Egyptian papyrus.

The first consists of an account, with a large atlas of plates, of the investigations which have been made in regard to the obstruction in the way of navigation of the outlet of the Danube, through several channels along the delta of the river. This subject appears to have been of so much importance that a commission was instituted in accordance with the provisions of the treaty of Paris of 30th March, 1856, including the representatives of seven different powers. The body of the memoir in question gives an extended account of the following subjects: 1. Preliminary investigations and preparatory works; 2. The choice of the mouth to be improved, and an elaboration of a definite project; 3. The provisional work. An appendix presents the report of the chief engineer, Sir Charles Hartley, containing: 1. A general description of the delta of the Danube; 2. The formation of the bars; 3. The means of improving the entrance to the river; 4. A comparison of the different branches; 5. The result of meteorological and technical observations from 1859 to 1865; 6. Statistics relative to commerce and navigation. The memoir is accompanied by a large atlas of 40 double-folio colored plates.

The work is one of great value to the engineers of this country, in reference to the improvements which will doubtless be undertaken in regard to the rivers and water-courses of the United States. To this subject public attention has not been directed with an intensity commensurate with its importance.

If we cast an eye on the map of the United States and view the relation which exists between the vast body of water in the northern lakes and the branches of the Mississippi and the Ohio, we must be struck with the means which nature has placed within the power of man for improving the navigation of the great water-courses which form the channels of communication between the interior of the country and the sea-board.

We have, in a previous report, mentioned the interesting fact that among our correspondents was the Institute of Egypt, founded at Alexandria in 1859. Since then our correspondence with that country has been kept up, and more especially increased during the last year by the visit to that country of one of the members of the Board of Regents, General Sherman. We have received from General Stone, of

the Egyptian army, an interesting chart of the fluctuations of the Nile, and from the author, Auguste Mariette Bey, the fac-similes of the Egyptian papyrus in the museum of Boulaq, prepared under the auspices of S. A. Ismail Pacha, Khédive of Egypt. These fac-similes occupy forty-four folio-plates, on tinted paper, representing in color and form the present appearance of the papyrus.

Among the donations to the library should also be mentioned a collection of two thousand drawings of fishes, including copies of all known engravings of fishes published up to 1834, made by Dr. A. Reuss, formerly of Germany, but now of Belleville, Illinois.

WORK DONE IN THE INSTITUTION AND IN CONNECTION WITH OTHER ESTABLISHMENTS.

The Secretary, from the first organization of the Light-House Board, has been one of its members, and has acted as chairman of the committee on experiments. In this capacity he has made in past years an extended series of investigations relative to different materials of illumination, also investigations relative to different instruments proposed for fog-signals, besides reporting on a large number of propositions made to the board with the idea of improving the aids to navigation. During the last year he continued the investigations in regard to fog-signals, and for this purpose spent his last summer's vacation on the coast of Maine. For these services he receives no other compensation than ten cents a mile as traveling expenses. The work is one, however, in which he takes great interest, and it has been to him a source of diversity of employment and a means of improved health.

He has, during the past year, upon the retirement of Admiral Shubrick, been elected chairman of the board.

The Secretary is also one of the visitors to the Government Hospital for the Insane, and as President of the National Academy of Sciences directed the preparation of the instructions for scientific observations for Captain Hall's arctic exploration. In addition to the foregoing, the Government placed the direction of the exploration of Major Powell in charge of the Smithsonian Institution.

Appropriations have been made at the last two sessions of Congress for investigations, under the direction of Professor Baird, of this Institution, relative to the alleged decrease of food-fishes on our coasts. To this at the last session was added an appropriation for stocking the rivers and lakes in the United States with useful fishes. These investigations have occupied all the time and attention he could spare from his duties in connection with the Smithsonian Institution.

Besides the prominent subjects of immediate inquiry, there were quite a number of collateral matters bearing on the general questions, which were prosecuted at the same time, and which have in themselves much scientific interest. His headquarters for the season were fixed at Eastport, on the Bay of Fundy; and, with Professor Verrill to take charge of the

invertebrate fauna, he was enabled to gather, both at Eastport and Grand Manan, immense numbers of specimens, which, when fully elaborated, will be distributed to various scientific establishments throughout the world. With the facilities furnished by the Government in authorizing the use of the revenue-cutter Mosswood whenever necessary, the party was enabled to carry on these researches in every branch of the inquiry, including dredging and temperature-observations at great depths in the Bay of Fundy. Every facility was heartily rendered in this work by Captain Hodgdon and his officers. For a portion of the time a detail of the party, consisting of Professor Webster and Mr. C. H. Pond, was occupied at Cape Porpoise, south of Portland, as also at the island of Grand Manan.

By permission of Professor Peirce, the Superintendent of the Coast-Survey, Professor Baird also placed a party on board the Coast-Survey steamer Bache while surveying the Georges Banks and other shoals off the coast of New England; this detail consisting for a time of Mr. S. J. Smith, and Mr. Oscar Harger, of Yale College, and afterward of Dr. A. S. Packard, jr., and Mr. Cook, of Salem.

The additions to our knowledge of the natural history of the American seas made by all these parties has been very great, and the results will be published in detail in the report of the commissioner to be made to Congress.

While engaged at Eastport himself, Professor Baird had a party also at Wood's Hole, the scene of his labors during the year 1871; and several interesting additions to the known fauna of the Vineyard Sound region were made, among them, two genera and species of the sword-fish family, previously unknown on the coast of the United States; and other specimens of marine animals, especially of fishes, were contributed by Mr. Samuel Powell, of Newport.

The following is an account of the work done by Mr. F. B. Meek, who still retains his apartments in the building, and examines and reports to the Institution all specimens of paleontology and geology submitted to it for examination.

Most of his attention during the year 1872 has been devoted to the invertebrate paleontological department of the Ohio State geological survey. The collections have been sent to him at the Smithsonian Institution. He has, from time to time, published preliminary papers on these fossils in the Proceedings of the Academy of Natural Sciences of Philadelphia and the American Journal of Science and Arts, and subsequently prepared more elaborate descriptions for the first volume of the Final Report of the Ohio Geological Survey, in charge of Dr. J. S. Newberry. He has also had the drawings, illustrating his part of this volume of the Report, and a part of those for the second volume, made in the Institution, under his immediate direction; and has likewise arranged the plates and superintended the engraving of the same, so far as completed.

In the early part of the year he prepared for publication some notes on the geology of the country immediately about the White Sulphur Springs, of Greenbrier County, West Virginia, with figures and descriptions of a few new fossils. He has likewise superintended the engraving of the quarto-plates of fossils from the Upper Missouri country, illustrating a report on the region, to be published by the Government in connection with the results of the United States Geological Survey of the Territories, in charge of Dr. Hayden.

On account of failing health he was induced to avail himself of an opportunity to spend the summer in the Rocky Mountains and along the Union Pacific Railroad through to the Pacific, during which journey he collected specimens and made observations at the expense of the Government survey. Since his return he has prepared descriptions of some forty or fifty new species of fossils collected during his journey, to be published in Dr. Hayden's report.

METEOROLOGY.

Among the first acts of the Institution was the establishment of a system of meteorology, intended especially to gather trustworthy information as to the character of American storms and the general climatology of the United States. To assist in this enterprise, Mr. James P. Espy was for several years previous to his death associated with the Institution. Lieutenant Maury, then in charge of the Observatory, had previously established a system of meteorology for the sea, and for several years another system had been carried on by the War Department at the various military posts of the United States, besides subordinate systems in the States of New York, Massachusetts, and Pennsylvania.

It was the intention of the Institution to harmonize these different systems, and, as far as possible, to reduce and discuss the results on one general plan. For this purpose it had prepared at its expense, by Professor Guyot, a volume of meteorological tables, also a series of instructions, and introduced a set of trustworthy instruments, constructed by Mr. James Green, of New York.

The Institution was the first to employ the telegraph in the prediction of the weather; but as its income was not sufficient to carry on this operation to its full extent, and owing to the interference of the war, the project was for a while abandoned. The proposition was, however, afterward brought before Congress by other parties, and a system of weather-forecasts established under the direction of the War Department, in the especial charge of Chief Signal-Officer General A. J. Myer.

The placing of this system of forecasts under the War Department gave it special advantages not otherwise to be secured by it. The observers are all enlisted in the Army and paid out of the Army appropriations. The whole being under military discipline gives the system a regularity and efficiency which leaves nothing in this respect to be desired. The

appropriation for the support of the system has thus far been very liberal, and I do not doubt it will continue to be so from year to year.

Since the establishment of the Government system of weather-forecasts I have proposed, on the part of the Smithsonian Institution, to abandon the field of meteorology to General Myer, preserving to the Institution only the labor of discussing and reducing all the observations which it has collected from its own observers and from all others in the country up to, say, the year 1872. To this proposition I have not as yet received a reply.

The Smithsonian system includes at present about five hundred observers, who give their services voluntarily. They are of two classes: those who report upon the barometer, thermometer, psychrometer, rain and wind gauges, and those who report upon only the temperature, the wind, the face of the sky, and the rain. Of the first class there are about one hundred and fifty, and these serve as standards to which the observations of the second class are referred. Most of the instruments of the first class have been constructed by Mr. Green. The rain-gauges are of a very simple form, consisting of merely a cylinder of tinned iron, two and a half inches in diameter and twelve inches deep, in which the rain is measured to within half a tenth of an inch by the insertion of a graduated slip of wood.

If the system just described were incorporated with that of the Government, and an agent sent from time to time throughout the country to instruct the observers, the whole would form a more extended and perfect system than any now in existence. The voluntary observers would render good service in supplementing the more precise observations of the Army in marking the extent and boundary of special conditions of the atmosphere and in noting casual phenomena, such as thunder-storms, auroras, tornadoes, &c.

The Smithsonian system has now been in operation more than twenty years, and the Institution is at present occupied in reducing and discussing the observations up to 1870 for publication. The only part of the results as yet published is that relating to the rain-fall. The part relative to the winds will be put to press in the course of a few months. All the observations on the winds which the Institution has been able to collect from unpublished and published records were placed in the hands of Professor J. H. Coffin, of Easton, Pa., who has nearly completed their discussion. Of this discussion of the "winds of the globe," which has been made at the expense of the Institution, excepting as far as the labors of Professor Coffin were concerned, the tables have nearly all been completed, and the preparation of the maps and descriptions alone remains to be done previous to putting the work to press.

All the temperature-observations have been for several years placed in charge of Mr. Charles A. Schott, of the Coast Survey, and are being reduced as rapidly as the appropriation for the purpose from the Smithsonian income will allow. The first division of this work has been com-

pleted, and will be sent to press during the coming year. This section consists of tables and discussions necessary to reduce observations taken at different times of the day to the true mean of the day, and other general corrections of irregular observations, and hence it was necessary that this should be prepared first. It includes—

1. General remarks on the explanation and extreme cases of the daily fluctuations of the temperature; investigation of the corrections to the mean temperature from certain hours of the day to refer it to the true mean of the day.

2. Tables of times of sunrise and sunset for every tenth day of the year, and between latitudes 23° and 60°.

3. Applications of Bessel's circular function to represent the daily fluctuation, (yearly average;) the results for twenty stations are given.

4. Classification of the daily fluctuation into six typical forms; epochs of maximum and minimum, and of mean values and daily range, (with two diagrams.)

5. Annual variation in the range of the daily fluctuation, (with two diagrams;) and extremes of daily fluctuation in December and June, (with three diagrams;) also table of recorded daily range of temperature for every month and for certain stations.

6. Variability of the temperature at any hour from the normal value of that hour, specially investigated for Toronto, Mohawk, Philadelphia, and Sitka.

7. Table of the mean values of the hourly, bi-hourly, or semi-hourly observations of temperature, for every month, at nineteen stations.

8. Table of the daily fluctuations of temperature derived from the preceding table, and showing, for every hour and for each month and the year, the difference from the respective daily mean temperature.

Self-registering instruments are absolutely necessary for this kind of investigation, and when their readings are applied will place the results on a more satisfactory footing, and one commensurate with the importance of the subject.

The following is the condition of the work, which has been continued during the past year with the labor of two computers:

1. Consolidated tables, giving the mean temperature for each month, season, and the year, have been prepared for the following States, &c.: Alabama, Alaska, Arizona, Colorado, Dakota, Idaho, Nebraska, West Virginia, Greenland, Iceland, British North America, and part of New York.

2. A large number of observations made at Havana, Cuba, have been computed and added to the general tables. Various other additions have been made and many deficiencies supplied.

3. About three-fourths of the annual means at the different stations have been calculated, embracing about 7,000.

4. The maxima and minima tables have been nearly completed.

MISCELLANEOUS.

At a meeting of the British Association in 1868 a committee was appointed for the purpose of obtaining observations in various localities on the rate of increase of underground temperature downward. This committee (through its secretary, Prof. J. D. Everett) has requested the Institution to furnish observations on this subject from the United States.

These observations are generally made by noting the temperature in artesian wells; and although a large number of these borings for water have been made in this country, the precautions to be taken, and the skill required, in obtaining the true increase of temperature in relation to the depth are of a character not to be intrusted to ordinary observers; and, therefore, to meet the requirements of the committee, a special agent will be necessary to visit the different localities. The income of the Institution, up to this time, has not permitted the incurring of the cost of such an agency, although we hope in the future to be able to make an appropriation for the purpose. In the mean while we have intrusted a set of four standard thermometers, furnished by Professor Everett, and compared at the Kew Observatory, to Mr. B. D. Frost, engineer of the Hoosac Tunnel, Massachusetts.

The investigation is one of great interest to the geologist, being intimately connected with the hypotheses concerning the geological changes to which the globe, has been subjected. The fact has been fully established that, in every part of the world where observations have been made, after descending a few feet below the surface or beyond the depth at which the temperature of the ground is affected by variations in the solar heat, there is a gradual increase of temperature varying in the rate of increase at different places, but on an average not far from one degree in every sixty feet, or a rate which, if continued, would indicate the fusing-point of iron at a depth of about twenty-eight miles.

At the last meeting of the Board the subject of the desirability of the franking privilege to the Institution was discussed, as it had frequently been at previous meetings. Hon. Mr. Hamlin, who is a member of the Post-Office Committee of the Senate, offered to endeavor to procure action of Congress in regard to this object, and accordingly at the last session the following law was enacted.

"All publications sent or received by the Smithsonian Institution, marked on each package 'Smithsonian Exchange,' shall be allowed to pass free in the mail." (New Postal Code, 6th subdiv., 183d sec.)

It will be seen from the above that the franking privilege is confined to printed matter, and does not relieve the Institution from the burden of its large letter-correspondence, and, above all, from a new and unexpected source of expense in the mineral specimens which, since the transfer of the collection of the Land-Office to the museum of the Institution, are sent by mail from the different Government surveyors. We

have before us a lot of specimens from one Government officer on which postage of upward of thirty dollars is charged. Unless provision is made for the transmission of these to the Institution through the mails free of cost, as it was in the case of the Land-Office, we shall be obliged to decline receiving them.

By the will of Henrietta Jane Bedford, of Wilmington, Del., daughter of Hon. Gunning Bedford, jr., one of the framers of the Constitution of the United States, aid-de-camp to General Washington, and first district judge of the United States for the district of Delaware under the Constitution, a bequest was made to the Smithsonian Institution of a pair of pocket-pistols, presented to her father by General Washington; also a silver punch-strainer, said to have been made out of a silver dollar earned by Benjamin Franklin on the first day newspapers were carried round the city of Boston for sale. In case these bequests should not be accepted by the Institution, they were to be given to the Historical Society of Delaware.

While the motive which induced this bequest is fully appreciated, the objects, not being of a kind now in its collections, which relate more especially to natural history and anthropology, the Institution preferred that they should be presented to the Historical Society of Delaware.

At the request of the ladies in charge at Mount Vernon it has been thought proper to deposit with them the model of the Bastile of Paris, presented to General Washington; an iron stirrup of a saddle used by Mrs. Washington; and a small picture of Mount Vernon. These articles came into the possession of the Institution from the effects of the National Institute, and can be reclaimed for the National Museum at any time it may be thought important to obtain possession of them.

It was mentioned in the last report that a portion of the large room in the second story of the building was used for the exhibition of the cartoons or original sketches of Indian life, made by the celebrated Indian student, George Catlin. Mr. Catlin continued his exhibition of these pictures during the summer, and devoted all his time not occupied in explaining his pictures to visitors, to finishing the sketches. Unfortunately, in passing between the Institution and his boarding-place, which were separated by the distance of more than a mile, he exposed himself to the heat of the unusually warm summer, and was seized with a malady which terminated his eventful life on the 23d of December, 1872, in the seventy-seventh year of his age.

Since the subject will again come before Congress, I may here repeat what was said in my report last year relative to the purchase by Congress of the Catlin collection: "The entire collection, which comprises about twelve hundred paintings and sketches, was offered by Mr. Catlin to the Government in 1846, and its purchase was advocated by Mr. Webster, Mr. Poinsett, General Cass, and other statesmen, as well as by the principal artists and scholars of the country. A report recommending

its purchase was made by the Joint Committee on the Library of Congress, but, owing to the absorption of public attention by the Mexican war, no appropriation was made for the purpose. Mr. Catlin made no further efforts at the time, but exhibited his pictures in Europe, where, on account of an unfortunate speculation into which he was led in London, claims were brought against them which he had not the means to satisfy. At this crisis, fortunately, Mr. Joseph Harrison, of Philadelphia, a gentleman of wealth and patriotism, desiring to save the collection for our country, advanced the means for paying off the claims against the pictures, and shipped them to Philadelphia, where they have since remained unredeemed. Mr. Catlin, however, retained possession of the cartoons, and has since enriched them with a large number of illustrations of the ethnology of South America. Whatever may be thought of these paintings from an artistic point of view, they are certainly of great value as faithful representations of the person, features, manners, customs, implements, superstitions, festivals, and everything which relates to the ethnological characteristics of the primitive inhabitants of our country. We think that there is a general public sentiment in favor of granting the moderate appropriation asked for by Mr. Catlin, and we trust that Congress will not fail to act in accordance with this feeling." It is the only general collection of the kind in existence, and any one who has given thought to the subject could scarcely fail to sympathize with the last anxious feelings of Mr. Catlin that, after a life of devotion to Indian ethnology, these results of his labors might be purchased by the Government. To insure the permanent preservation of the collection, Mr. Catlin would have gladly presented the pictures to the Government as a gift had he not expended all his worldly possessions in the formation of the collection, and therefore had nothing wherewith to redeem the portion of the general collection pledged for debt or to bestow upon his three orphan daughters.

NATIONAL MUSEUM.

Until the year 1870 the support of the National Museum principally devolved on the Smithson fund, only $4,000 having been annually appropriated by Congress for this purpose. Since that date, however, Congress has indicated an intention of providing for the full support of the museum. In 1870 and 1871 it appropriated $10,000, and in 1872, $15,000. This last sum, however, is scarcely yet sufficient to defray the expenses.

The cost of the reconstruction of the building, exclusive of furniture, after the fire of 1865, was $136,000, the whole of which was paid from the Smithson income. This expenditure was for restoring the main building and not for fitting up rooms wanted for the further extension of the museum. For the latter purpose, Congress has made appropriations, since 1870, amounting in all to $35,000. Of these appropriations $20,000 have been expended in ceiling, flooring, plastering, and

finishing the great hall, occupying the entire second story of the main building, intended for the extension of the museum; and, with the remainder of the appropriation, arrangements have been made for furnishing with cases this room, and also the room formerly occupied by the library, and now devoted to mineralogy and geology.

With a view to the entire separation of the affairs of the museum from those of the Smithsonian proper, all the operations of the latter, with the exception of those in the Regents' room, are carried on in the east wing and range of the building, leaving all the other parts, including the main edifice, towers, west wing, and west range, to the museum

The following is Professor Baird's account of the additions to the Museum, and the various operations connected with it during 1872:

Additions to the National Museum in 1872, *in geographical sequence.*— The additions to the National Museum, in charge of the Smithsonian Institution, during the year have shown a gratifying increase over those of 1871, and have been decidedly equal in value to those of any previous year. The great bulk, as might be expected, has been derived from the collections of the various Government expeditions, especially those under the charge of Professor Hayden, Professor Powell, and Lieutenant Wheeler, supplemented, however, by others, contributed by private effort, especially on the part of Mr. Henry W. Elliot and Mr. William H. Dall.

A great addition to the magnitude of a portion of the cabinet, namely, that of mineralogy and geology, has been the result of the transfer to the Institution, under the order of the Secretary of the Interior, of the extensive museum of the Land-Office.

In the appendix to this report will be found a detailed list of the donors of the various specimens, together with the general indication of their nature; but with a view of calling attention more particularly to the different regions represented therein, I beg leave to present some remarks, both in regard to the auspices under which they were secured and their general character.

As in previous years, the principal regions of America are more or less represented among the additions in 1872, and these, as usual, will be mentioned in systematic order.

Beginning, therefore, with the Northwest Coast, we have, in the first place, from the Island of Saint Paul, one of the fur-seal group in Behring Sea, a very extensive collection, presented by Mr. Henry W. Elliot, for a long time connected with the Institution. This gentleman visited the two seal-islands, Saint Paul and Saint George, as an assistant agent of the Treasury Department, to attend to the interests of the Government with the Alaska Commercial Company, and to look after the welfare of the native tribes. The collection embraces a large number of skeletons of many species of water-fowl, as well as their skins and eggs, quite a number of which are new to the national collection; also various

fish, mollusca, and other marine objects, together with minerals, rocks, and plants.

Mr. William H. Dall also contributed largely from the region a little to the south of that occupied by Mr. Elliot, namely, Unalaska and some adjacent islands. The most marked feature of Mr. Dall's contribution consists in the rich collections of pre-historic objects, some of them found in localities of which the native Aleuts have no tradition as being the site of ancient settlements. The series is of interest, as showing the state of civilization among the progenitors of these people. Other objects collected by Mr. Dall consist of marine invertebrates, fishes, and numerous birds, eggs, &c. Among the eggs are several new kinds, which, with the contributions by Mr. Elliot, nearly complete the desiderata of the National Museum in regard to the water-birds of the North Pacific.

Some contributions have also been obtained from Professor Harrington, the companion of Mr. Dall. It should be stated that Mr. Dall has been engaged since July, 1871, in the service of the Coast Survey, in surveying the Aleutian Islands, and that the collections made by him, like those of Mr. Elliot, were gathered entirely at his own expense, at such periods as could not be occupied by any regular official work. In addition to the specimens just named, skulls of rare species of cetaceans were supplied by Captain Scammon, who has also added to them others from Southern California.

From Oregon have been received several series of Indian relics, and a number of human and other crania, presented by Mr. Bissell.

California has furnished some curious remains of fossil vertebrates from Point Conception, presented by Mr. Sceva, and collections of Sacramento *salmonidæ* from Mr. Stone. Dr. L. G. Yates has continued his contributions of ancient relics, as also of minerals and fossil remains. Some rare birds' eggs and nests have been furnished by Mr. William A. Cooper, of Santa Cruz.

From the States and Territories in the interior of North America, especially those of the Great Basin and of the Rocky Mountain region, the collections have been principally made on the part of the Government expeditions, nearly all of which have had the center of their operations within these boundaries. Among these we may mention, first, the parties of Professor Hayden, who renewed in 1872 his explorations of 1871 in the Geyser basins of the Upper Yellowstone, as also farther to the west, in the regions between Fort Hall and the Three Tétons.

In addition to the researches prosecuted by his own immediate party, and its division under charge of Mr. Stevenson, with Professor F. H. Bradley as geologist, there were several subsidiary explorations prosecuted in connection with Dr. Hayden's labors, by Professor Joseph Leidy in Wyoming, and by Professors Meek and Bannister, Professor Lesquereux, and Professor E. D. Cope, all of whom added largely to the general collections, the total number of boxes of specimens re-

ceived from Professor Hayden's expedition amounting to very nearly one hundred.

The labors of Lieutenant Wheeler in the more southern portions of the region referred to were continued throughout the season, with Messrs. Gilbert and Howell as geologists, Dr. Yarrow as surgeon and chief naturalist, Mr. Henshaw as assistant naturalist, and Mr. Severance as ethnologist. The investigations of these gentlemen were prosecuted in Southern Utah and in Eastern Nevada, and resulted in the acquisition of rich collections of geological specimens, as also of a large series of animals, especially of the vertebrates. The ethnological contributions of the party were also of much interest.

Professor Powell also, in continuation of preceding explorations along the Colorado River, devoted himself more particularly to the collection of Indian remains, and succeeded in procuring a very extensive series of everything illustrating the habits and manners of the interesting tribes that now occupy that region.

From Governor Arny, of New Mexico, the museum has received some valuable minerals, and numerous articles of dress and ornament of the Apaches and other modern tribes. He has also contributed the remains of what Dr. Leidy considers to be a new species of American fossil elephant, and other bones of the same species were supplied by General J. H. Carleton.

Some interesting reptiles of New Mexico were contributed by Dr. Bailey. Other collections of less extent will be found mentioned in the table of list of contributions.

From the valley of the Mississippi have been received human remains from the mounds of Dakota, contributed by General Thomas; from Louisiana and Mississippi, casts of some very remarkable stone implements, furnished by Professor Joseph Jones, of New Orleans; and also original flint objects, together with insects, from Mr. Keenan.

Mr. J. G. Henderson has lent us the rarities of his fine ethnological collection, gathered principally in Illinois, with permission to duplicate them by means of casts; while from Mr. Peters, of Kentucky, Mr. Anderson, of Ohio, and other gentlemen, additions have also been made to the ethnological department.

From the chain of lakes extensive contributions in the way of food-fishes have been furnished by various parties. Among them may be mentioned, as the most important contributor, Mr. J. W. Milner, deputy commissioner of fish and fisheries for the lakes. His transmissions embrace the different species of trout and white-fish in great variety.

In obedience to the instructions of the minister of marine and fisheries of Canada, the fish-wardens on the lakes have also supplied specimens of trout and white-fish from Lake Erie, Lake Ontario, Lake Champlain, the Saint John's River, &c. These have been received from Messrs. Kerr, Kiel, Macfie, and others.

The State of Maine is very amply represented in the collections of

the year by means of the specimens of marine animals collected by Professor Baird as United States commissioner of fish and fisheries, and his assistants and associates. In addition to the collections made on the coast of Maine, the Institution has received, through the commissioner of fish and fisheries, a valuable series of the salmon of the Penobscot River from Mr. Atkins; of the blue-backed trout of the Rangely Lakes from Mr. Stanley; and lake-trout and land-locked salmon of the Saint Croix from Senator Edmunds. Marine animals in great variety and of much interest were also collected for the fishery commission at Fort Macon, North Carolina, by Dr. H. C. Yarrow, assistant surgeon of the United States Army, supplemented by others from Dr. Mackie.

The donations from the interior of the Atlantic coast States consisted of Indian relics from Mr. Kellogg, of Connecticut; minerals and rocks of South Carolina from Mr. Waldo; and various specimens of birds from Florida from Mr. George A. Boardman. The trustees of the Charleston College have been kind enough to lend to the Smithsonian Institution, to be copied in plaster, several unique objects of ethnology.

Proceeding to the regions south of the United States, we may mention, first, contributions from the Isthmus of Tehuantepec, furnished by Professor Sumichrast, these consisting of numerous birds and reptiles, in continuation of similar collections previously transmitted. Mr. Florentin Sartorius, of Vera Cruz, also furnished specimens of the rare and curious wax-producing insects first described as *Lystra cerifera*.

From Guatemala have been received collections of insects, presented by Mr. F. Sarg, and from Nicaragua a collection of rare pottery, by Dr. Earl Flint. Certain collections made several years ago by Dr. Berendt near Belize were received during the year, consisting principally of reptiles and shells. As these were gathered at the expense of the several contributors to a common fund, they were assigned for distribution to Mr. Thomas Bland and Professor Cope.

Of South American regions, New Granada is represented by a collection of birds presented by the American minister at Bogota, Mr. Hurlbut; Southern Brazil by the skeleton of a tapir from Mr. Albuquerque; and Chili by a very valuable collection of native minerals from the University of Santiago, through Professor Domeyko, and a collection of Chilian eggs of great interest from the national museum, through Dr. Philippi.

Perhaps the most interesting South American object is a human head prepared by the Jivaro Indians of the province of Chimborazo, Peru, and presented to the Smithsonian Institution by Don Edward de Feiger, through the honorable Rumsey Wing, United States minister to Ecuador. This head belongs to a very rare series of ethnological objects, of which a very few only have been brought to Europe and America. They are held by their owners in much veneration, and jealously guarded as household divinities. They are believed to be trophies of victories; the head of an enemy being thus prepared for permanent preservation. The

precise method of manipulation is unknown, but is supposed to consist in the careful extraction of the bones, flesh, and brains of the head, and the subsequent contracting of the skin by some astringent. The result is a well formed and quite symmetrical head, about four inches in diameter; all parts contracted in equal proportion, and with long flowing black hair; a braid of strings is passed through the lips, and there are several other artificial appendages.

Prof. William M. Gabb has kindly presented to the National Museum some extremely rare and remarkable stone implements and pottery from San Domingo, while Professor Poey, the eminent and veteran naturalist of Havana, has supplied a series of fishes from Cuba as types of his species.

Fishes of Bermuda were also received from Mr. J. Brown Goode.

The collections from other parts of the world, as might naturally have been expected, have not been so great, either in number or value, as those already referred to, although some of them are very important, as tending to complete the series already in the museum. The most interesting of these objects are certain pre-historic stone implements, especially of the drift-period, presented by Mr. William Blackmore, of England, and a similar collection furnished by Mr. Baker.

Professor Holst, of Christiania, has supplied a series of minerals from Konigsberg, a mining-region near that city, while Dr. Sars and Dr. Boeck have furnished specimens of the crustacea, Mr. Robert Collett of the fishes, and Dr. William Boeck a skeleton of *Hyperoodon*. Dr. Möbius, of Kiel, has also sent us a series of the food-fishes and crustaceans from the vicinity of Kiel.

No collections are recorded from Africa, with the exception of a superb skull of the Koodoo antelope, from Captain Holmes. From Japan, however, have been received some remarkable stone and bronze implements of pre-historic times, presented by the Japanese minister, Mr. Mori.

The Sandwich Islands are represented by collections of skulls and ethnology, from Mr. Valdemar Knudsen.

Systematic summary. The preceding enumeration expresses the geographical relations of the collections received during the year; and it may be well, in addition, to make a brief systematic reference to the principal objects received, so far as this has not already been done, especially as some general collections, covering a wide range of country, have not yet been referred to.

The department of ethnology has been especially enriched, not only by the collections of Professor Powell, Mr. Dall, Professor Hayden, and others, but very largely by a contribution from Mr. Vincent Colyer. This gentleman, while connected with the Board of Indian Commissioners, took occasion during his official visits in various parts of the Indian country to collect, at his own expense, large numbers of objects, all of which are now in possession of the Institution.

The head of the mummy, presented by Don Edward de Feiger, already referred to, is perhaps the most important of the ethnological series; but there are other objects of very great interest worthy of note. Among them, one of special interest, is an Indian pipe of black slate, carved in a very striking likeness of a loon, found in West Virginia and presented by Rev. J. N. Davis.

In the department of mineralogy and geology, the additions brought in by the parties of Lieutenant Wheeler and Professor Hayden have been especially rich; the donation of Chilian minerals by Professor Domeyko, and of Norwegian by Dr. Holst, will do much to increase the value of this portion of the collection.

The most important addition, however, is that of the Land-Office collection of minerals, embracing many thousands of specimens, and especially rich in series of ores from Nevada, Arizona, Utah, Colorado, and California. These collections will shortly be arranged with others of the same character in the new mineralogical hall.

In the department of zoology, a contribution from the Imperial Zoological Museum of Vienna, of skeletons of large mammals, such as those of the lion, tiger, giraffe, brown bear, &c., may be considered as chief in value. The skeleton of the Brazilian tapir, from Mr. Albuquerque, is also of much moment, as rendering the collection of American tapirs nearly complete. We previously possessed skeletons of the tapir of the Andes from Mr. Hurlbut, the Panama tapir from Captain Dow, and the Guatemala tapir from Mr. Henry Hague; the last additions making skeletons of four perfectly distinct species or varieties of this animal.

The skeletons and skulls of the cetaceans of the west coast from Captain Scammon, a skeleton of hyperoodon whale from Dr. Boeck, and skeletons of many hundreds of birds from Henry W. Elliot may also be enumerated.

Among mammals, the chief accessions have been that of a Rocky Mountain goat, from W. J. Wheeler, since mounted and placed in the collection; that of a gnu from an unknown source, and the restoration in full size of the Irish elk, deposited by Mr. Waterhouse Hawkins.

The Royal College of Surgeons of London has contributed a collection of casts of the brains of mammals.

Of birds, a valued addition is that of the rare Labrador duck from the Museum of Natural History of New York; and the extensive collections of Professor Hayden, of Lieutenant Wheeler, of Mr. Dall, and of Mr. Henry Elliot embrace many important specimens. The eggs from Messrs. Dall and Elliot, taken in Alaska, and those from Chili, are of principal value.

The collection of fishes has been very large, made principally by or in behalf of the commission of fish and fisheries. It embraces specimens of the *Salmonidæ* of the Sacramento River, received from Mr

Livingston Stone, and of various localities on the great lakes, and in the States of Maine and New Hampshire.

The marine collections from the coast of Maine, Vineyard Sound, Rhode Island, Fort Macon, Cuba, and the Bermudas have already been referred to. The European collection presented by Messrs. Sars, Boeck, and Collett, as also those of Dr. Möbius, of Kiel, will also be of much value for purposes of comparison.

The invertebrates gathered under similar auspices have also been very numerous, and will furnish ample means for distribution to other museums.

In accordance with the policy of the Institution, all the specimens of human anatomy, including crania and skeletons from the ancient mounds, have been turned over as soon as received to the Army Medical Museum, while the insects and the plants have, in like manner, been deposited with the Agricultural Department.

The total number of distinct donations received during the year 1872 amounted to 315 entries, comprising 544 separate packages and coming from 203 different donors.

The corresponding figures for the year 1871, consist of 271 donations, comprising 400 packages.

Work done in the museum.—The addition of so large a stock of material to the collections already in charge of the Institution, of course, involved a great deal of labor, such as the unpacking and classifying of the objects; the labeling of all, at least as to localities; the entering in their respective record-books; the putting such of them in order as required it; placing such as were ready for immediate exhibition on their respective shelves; and storing the rest away where they could most readily be referred to on occasion.

All dry objects of an animal nature generally need prompt attention to prevent their being affected by mold or by the attacks of insects; ethnological objects usually requiring to be thoroughly cleaned and poisoned, while skins of animals, furs, Indian robes, dresses, &c., must be immersed in some poisonous solution before they can be considered as permanently secure. All this has been effected with as much thoroughness as the time and force at the command of the Institution would permit.

In addition to this, it was found that the immense collection of objects of dresses and ornaments belonging to the ethnological galleries, were more or less infected by moths, and it became necessary to subject the entire series to a process of renovation, embracing many thousands of specimens.

The transfer of the mounted birds and mammals from the old stands to those of a neater form has also been prosecuted to a considerable extent during the year, several thousands having been so treated, to the manifest improvement of the general appearance.

Perhaps the most important labors in the museum have been that connected with the renovation of the extensive alcoholic collections. These were in a very unsatisfactory condition, in consequence of the fire of 1865, and the unavoidable confusion during the process of reconstruction of the various apartments of the Institution.

The bottles were necessarily stored in a damp cellar, where the labels became obliterated to a greater or less degree; and although the precaution had been taken to introduce within the jars numbers corresponding to those of the external label, yet both in many cases were found to have become illegible. It was necessary, therefore, to use every effort to remedy the difficulty by re-labeling such specimens as had not lost their history beyond recovery; and this work has occupied a considerable portion of the force the entire year. All the bottles, however, have been cleaned and placed in a dry cellar, and during the coming year this part of the collection will be put in as good order as can be desired.

A considerable portion of the time of the employés of the museum was occupied in the transfer of the extensive collection of rocks and minerals from the Land-Office, which has necessarily required great care to prevent the misplacement of the labels. This was, however, satisfactorily accomplished, and the specimens are now safely in the possession of the Institution, and, it is hoped, will be placed on their shelves in the course of the year 1873.

Quite a number of the skeletons of the larger animals, such as the Irish elk, several species of tapir, the American moose, the buffalo, American and European bisons, the elk, camel, &c., have been mounted during the year and placed in the general collection. There is yet much to be done in this direction, the museum fortunately possessing very complete series of the bones of most of the American mammalia and many foreign species. Several large mammals have also been mounted, such as the bison, the moose, walrus, and a considerable number of the larger fish found on the Atlantic coast.

Distribution of specimens.—In accordance with the policy adopted by the Smithsonian Institution in the administration of the collections of the National Museum, much has been done in the way of transmission of specimens to other museums at home and abroad.

Many of the rare and more choice stone implements in different museums throughout the country have been borrowed and duplicated by means of casts, and enough of these prepared to permit quite an extensive distribution.

The collections brought in by Professor Hayden during his different expeditions of several years past were all unpacked and arranged; and after reserving a series for the Museum of the Institution, the remainder were made up into some fifteen or twenty sets, which were distributed to different colleges and academies throughout the country. This branch

of the work of the Institution, it is hoped, can be greatly extended during the coming year, in view of the immense number of duplicates which will be found in the Land-Office collection and in the collections just received from the various Government expeditions.

A large number of specimens in mineralogy and geology were also boxed up and transmitted to Professor Egleston and Professor Newberry, of the School of Mines in New York, under the existing arrangement with those gentlemen to select and label a perfect single series for the National Museum and to exchange the duplicate specimens in its interest. Numerous returns have already been received of valuable material, adding greatly to the richness of the lithological department.

Dr. Coues, assistant surgeon in the Army, having volunteered to prepare a monograph of the smaller rodents of North America for publication by the Institution, received at Baltimore the entire collection of specimens, both in alcohol and in skins. Having subjected these to a careful criticism, he made the duplicates into thirty sets, which will be distributed in the course of the coming year to the different museums in this country and Europe, in return for which we shall doubtless receive some valuable additions to the cabinet.

A few of the small number remaining on hand of sets of minerals, geological specimens, shells, &c., have been sent out to various addresses, and as also several series of birds, &c., mammals, skeletons, eggs, &c. The entire number of specimens thus sent forth will be found in an accompanying table.

The museum may now be considered as in much better condition than it has ever been before. The process of renovation is progressing as rapidly as possible, and will, before long, be completed. The establishment of better store-rooms in which to keep the unmounted skins of animals, and the alcoholic collections, has enabled us to work to much better advantage. As fast as each department can be re-organized and placed in a satisfactory condition, pains will be taken to eliminate the duplicates, and distribute them as authorized. The result will be to greatly reduce the bulk of crude material to be cared for by the Institution, and to render a great service to the cause of scientific instruction by disseminating authentically-labeled types of the various species. Returns of great value may be expected also for these specimens.

There is, however, a great deal to be done before the collections at present in the National Museum may be considered as finally arranged, to say nothing of those yet to be received. The greater portion of the ethnological museum will need to be properly mounted on tablets, or otherwise prepared for permanent exhibition, and labeled. As soon as the cases in the large hall of the Institution can be completed, these specimens will be placed in position. It is intended to prepare a large number of effigies representing accurately the lineaments, dress, and form of the tribes of Indians, and to place upon these their correspond-

ing ornaments, weapons, &c.; and to introduce them, either singly or in groups, into suitable cases, where they can most readily be seen.

The approach to completion of the new cases for the mineralogical hall, formerly occupied by the library, makes it necessary to re-arrange all the mineralogical and geological specimens, these including not only such as have been for a long time in the Institution, but the newly-acquired treasures from the Land-Office, and the Government expeditions of 1872. These transfers will vacate a portion of the present exhibition-room, amounting, perhaps, to nearly one-third its present capacity; and it is proposed to occupy the gaps thus made by specimens of mammals, birds, and skeletons. Of these there are ample series in the building, enough, indeed, to fill several large rooms. Such a selection will be made from these as will make up the most important deficiencies in the mounted series at present on exhibition.

Mineralogical collection.—Under the authorization of the Secretary of the Interior, the Commissioner of the Land-Office transferred to the care of the Institution, as a part of the National Museum, the collection of minerals which had been formed by Mr. Joseph Wilson, the previous Commissioner. This collection, intended to illustrate the mineral resources of the country, consisted of samples of ores and geological specimens from every State and Territory in the Union. Though a very valuable addition to the Museum, it is formed in some degree of duplicates of specimens already in the Institution. This fact, however, will enable us to make up sets of duplicates for distribution to colleges and academies. It is proposed to continue the plan inaugurated by Mr. Wilson, of illustrating the mineral products of all parts of the United States in addition to a general systematic mineralogical cabinet. For the exhibition of the latter the large room formerly occupied by the library will be devoted, while the connecting range, by a few changes, will serve as the receptacle for the specimens to illustrate the former.

In concluding the history of the Institution up to the year 1872, it will be evident that the establishment has had, on the whole, a successful career, although it has not been free from mishaps, and the appropriation of the fund was not at first as conformable to the strict interpretation of the will of the founder as could have been wished, yet continued improvement has been made in this respect from year to year. Not only the state of the funds, but the character which the Institution has established over the world, will enable it to compare favorably with the management of any endowment with which we are at present acquainted.

Respectfully submitted.

JOSEPH HENRY,
Secretary Smithsonian Institution.

WASHINGTON, *February*, 1873

SMITHSONIAN INSTITUTION.

UNITED STATES NATIONAL MUSEUM.

Appendix to Secy's Rept.
1872, p. 55— gives
Entries in record-books,
Distribution of duplicate
specimens, and Additions
to Collections.

REPORT

OF

PROFESSOR JOSEPH HENRY,

SECRETARY OF THE SMITHSONIAN INSTITUTION,

FOR THE YEAR 1873.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1874.

REPORT OF THE SECRETARY, PROFESSOR HENRY, FOR THE YEAR 1873.

GENTLEMEN: I have the honor herewith to present a continuation of the history of the Smithsonian Institution, comprising an account of its operations, condition, and expenditures during the year 1873. No change in this time has been made in the general policy of the establishment. Congress has continued its appropriations for the support of the National Museum under the charge of the Institution, and has thus relieved the Smithson fund from a burden the support of which has annually absorbed a large portion of the income. Freed from the expense of the support of the museum, at the beginning of 1873 we anticipated doing much more than we had previously done in the way of advancing science without encroaching on the unexpended balance in the Treasury at the close of 1872, but in this we were disappointed by the failure of the First National Bank of Washington, which had in its possession at the time of its suspension a considerable portion of the semi-annual income received on the 1st of July, and which was intended to carry on our operations during the remainder of the year. Previous to 1867 the interest on the Smithson fund was deposited in the private banking house of Riggs & Co., but at the session of the Board February 22, 1867, I was directed, by a resolution suggested by Chief Justice Chase, to transfer the money to the First National Bank, an authorized Government depository. This was accordingly done, and the bank faithfully discharged the duty which devolved upon it until the 19th of September, 1873, when it failed to honor our drafts. The whole sum in the bank at this time was $8,224.87. On this sum the Institution has since received a dividend of 30 per cent., amounting to $2,467.46. In order to meet this unexpected difficulty a reduction was made, as far as possible, in the accruing expenses, by stopping the printing of various articles, and deferring for a time the prosecution of various enterprises in which the Institution had previously embarked.

For paying the salaries and other urgent claims an application was made to the Secretary of the Treasury to advance the quarter-yearly interest which had accrued on the 1st of October. To this application the Secretary, Mr. Richardson, gave due attention, and expressed his willingness to grant the favor provided it could be done in accordance with law. It was, however, decided by the comptroller that the interest could only be paid semi-annually, as prescribed by the act organizing the Institution.

Disappointed in obtaining relief from this source, an appeal was made to Mr. G. W. Riggs to advance what might be required to pay the necessary expenses of the establishment during the remainder of the year. This he promptly consented to do at a time when loans of money could scarcely be obtained unless at the most exorbitant rates; and this, too, without charge for interest. Such liberality could scarcely have been expected, especially after the deposits had previously been withdrawn from Mr. Riggs on the plea of greater security.

To relieve the Board of Regents and the secretary in future from all anxiety as to the safety of the semi-annual interest, I would advise that hereafter it be placed in charge of the Treasurer of the United States. I am informed that he is authorized to receive on deposit, from officers of the Army and Navy, money which has been appropriated by Congress to special objects, and as the Smithson income is the proceeds of a sacred trust committed to the Government of the United States, the same privilege should be, and I doubt not would be, extended to it.

The Smithson fund since the war has been much diminished in efficiency by the inflation of the currency, and the consequent high price of labor and materials. It is true that the Government pays the Institution in gold, but the premium on this is by no means an equivalent for the diminution of purchasing power of the money received: since paper has been substituted as a legal tender, gold itself has become an article of commerce, the price of which depends on the supply and demand. While the premium on gold is, say, ten per cent., the difference of prices due to inflation is, in many cases, a hundred per cent. In addition to the effect of the diminution of the value of the Smithson fund by the inflation of the Government currency, is that of the gradual inflation of the currency of the world by the products of the mines of California and Australia. It is estimated that this, during the last twenty-five years, has made a difference in prices throughout Europe and this country equivalent to twenty per cent.

To keep up, therefore, the efficiency of the Smithson fund in the way of producing new results in intellectual labor, it was necessary that additions should be made to it; and from the following financial exhibit, and those which have been shown in preceding reports, it is evident that this consideration has received proper attention.

The following is a statement of the condition of the funds at the end of 1873 or the beginning of 1874:

The amount originally received as the bequest of James Smithson, of England, deposited in the Treasury of the United States, in accordance with the act of Congress of August 10, 1846	$515,169 00
The residuary legacy of Smithson, received in 1865, deposited in the Treasury of the United States, in accordance with the act of Congress of February 8, 1867	26,210 63
Total bequest of Smithson	541,379 63

Amount deposited in the Treasury of the United States, as authorized by act of Congress of February 8, 1867, derived from savings of income and increase in value of investments	$108,620 37
Total permanent Smithson fund in the Treasury of the United States, bearing interest at 6 per cent., payable semi-annually in gold	650,000 00
In addition to the above, there remains of the extra fund from savings, &c., in Virginia bonds and certificates, viz: Consolidated bonds, $58,700; deferred certificates, $29,305.07—now valued at	33,000 00
Cash balance in United States Treasury at the beginning of the year 1874, as a special deposit for current expenses.	12,226 68
Amount due from First National Bank, $5,757.41, (present value unknown.)	
Total Smithson funds January, 1874	695,226 68

PUBLICATIONS.

Since the reports of the Institution are separately distributed to individuals who have not immediate access to the whole series, it is necessary in each to repeat certain facts which may serve to give an independent idea of the general organization of the establishment. For this purpose the following statement is repeated in regard to the publications:

The publications of the Institution are of three classes—the Contributions to Knowledge, the Miscellaneous Collections, and the Annual Reports. The first consist of memoirs containing positive additions to science resting on original research, and which are generally the result of investigations to which the Institution has in some way rendered assistance. The miscellaneous collections are composed of works intended to facilitate the study of branches of natural history, meteorology, &c., and are designed especially to induce individuals to engage in studies as specialties. The annual reports, beside an account of the operations, expenditures, and condition of the Institution, contain translations from works not generally accessible to American students, reports of lectures, extracts from correspondence, etc.

The following are the rules which have been adopted for the distribution of the publications of the Smithsonian Institution:

1st. To learned societies of the first class which present complete series of their publications to the Institution.

2d. To libraries of the first class which give in exchange their catalogues and other publications, or an equivalent from their duplicate volumes.

3d. To colleges of the first class which furnish meteorological observations, catalogues of their libraries and of their students, and all other publications relative to their organization and history.

4th. To States and Territories, provided they give in return copies of all documents published under their authority.

5th. To public libraries in this country, not included in any of the foregoing classes, containing 15,000 volumes, especially if no other copies are given in the same place, and to smaller libraries where a large district would be otherwise unsupplied.

6th. To institutions devoted exclusively to the promotion of particular branches of knowledge are given such Smithsonian publications as relate to their respective objects.

7th. The reports are presented to the meteorological observers, to contributors of valuable material to the library or collections, and to persons engaged in special scientific research.

The distribution of the publications of the Institution is a matter which requires much care and a judicious selection, the great object being to make known to the world the truths which may result from the expenditure of the Smithson fund. For this purpose the principal class of publications, namely, the Contributions, must be so distributed as to be accessible to the greatest number of readers, and this will evidently be to principal libraries.

The volumes of Contributions are presented to institutions on the express condition that, while they are carefully preserved, they shall be accessible at all times to students and others who may desire to consult them. These works, it must be recollected, are not of a popular character, but require profound study to fully understand them; they are, however, of immense importance to the teacher and the popular expounder of science. They contain materials from which general treatises on special subjects are elaborated.

Full sets of the publications cannot be given to all who apply for them, since this is impossible with the limited income of the Institution; and, indeed, if care be not exercised in the distribution, so large a portion of the income will be annually expended on the production of copies for distribution of what has already been published that nothing further can be done in the way of new publications. It must be recollected that every addition to the list of distribution not only involves the giving of the publications which have already been made, but also of those which are to be made hereafter.

At the commencement of the operations of the Institution the publications were not stereotyped, and consequently the earlier volumes have now become scarce, especially the first, of which there are no copies for distribution, although it can occasionally be obtained at a second-hand book-stall in one of the larger cities.

No copyright has ever been secured on any of the publications of the Institution. They are left free to be used by compilers of books, without any restrictions except that full credit shall be given to the name of Smithson for any extracts which may be made from them.

This condition is especially insisted on, because the credit thus required is an important evidence to the world of the proper management of the Smithson fund.

Publications in 1873.—During the past year the eighteenth volume of the quarto series of the Smithsonian Contributions to Knowledge has been published. The several parts of this volume have been described in previous reports. It contains the following papers:

I. Tables and results of the precipitation in rain and snow in the United States, and at some stations in adjacent parts of North America, and in Central and South America. Collected by the Smithsonian Institution, and discussed under direction of Joseph Henry, Secretary. By Charles A. Schott, 4to., pp. 178, eight diagrams, five plates and three charts.

II. Memoir on the secular variations of the elements of the orbits of the eight principal planets, Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune, with tables of the same. Together with the obliquity of the ecliptic, and the precession of the equinoxes in both longitude and right ascension. By John N. Stockwell, M. A., 4to., pp. 214.

III. Observations on terrestrial magnetism and on the deviations of the compasses of the United States iron-clad Monadnock during her cruise from Philadelphia to San Francisco, in 1865 and 1866. By Wm. Harkness, M. D., 4to., pp. 225, with two diagrams.

IV. Converging series expressing the ratio between the diameter and the circumference of a circle. By William Ferrel, 4to., pp. 6.

This volume consists of 643 pages, and is illustrated by five plates, three large double charts, and numerous diagrams. The distribution of this volume to foreign societies has been nearly completed. As in the case of the preceding volumes, it will tend to perpetuate the name of Smithson conspicuously in the records of the history of science, and will thus form a more befitting monument to his memory than one of marble or of bronze.

One of the memoirs accepted for future publication in the Contributions is on the Lucernaria, by Professor Henry J. Clark. This memoir relates to a class of animals which are more or less octagonal, bell-shaped, or rather inverted umbrella-like, with tentacles clustered in groups at the eight angles. They were in former times regarded as a group of the polyps, that is, related to the sea-anemones, but in more recent times have been associated with the Acalephs or sea-nettles and jelly-fishes, and either combined with one of the more comprehensive orders, or regarded as the representatives of a peculiar one. Such is the group which has been the subject of Professor Clark's latest studies, and which is considered by him as entitled to ordinal rank in the class of Acalephs.

His work is divided into two parts; the first devoted to the "general and comparative morphology," and the second restricted to the "anatomy

and physiology of *haliclystus auricula*." In the first part are three chapters; the first on "individuality," in which are considered the questions relating to "polarity and polycephalism" and "the hydroid and medusoid cephalisms." In the second the thesis that "the type of form is not radiate" is defended, and the form is described as "the dorso-ventrally repetitive type." The third chapter is devoted to the consideration of "antero-posterior (cephalo-caudal) repetition," and under the heads of "the scyphostoma and ephyra varieties of the same morph" and "the individuality of Pelagia and Lucernariæ."

In the second part are four chapters, the third to seventh of the entire work. In the first (third of the work) are described the "general form and structure," including habitat, habits, form, and size, the proboscis, the umbella, and the peduncle. In the second is considered the "organography, including the walls," "the muscular system," "the tentacles, the marginal adhesive bodies, or collecystophora," "the caudal adherent disc," "the digitiform bodies, or digitali," "the digestive system," "the nervous system," and "the reproductive system."

In a third are embraced the results of studies of the "embryology," or various stages of growth of the species, including observations on "the egg and the spermatozoa;" on "a young *haliclystus auricula*, nearly one-sixteenth of an inch in diameter;" on "a specimen three thirty-seconds of an inch across the umbella;" on "a young specimen one-eighth of an inch across;" on the "special development of a tentacle, a colletocystophore, and a genital sac;" on the "young one-fifth of an inch across;" and on the "young six twenty-fifths of an inch across."

In a fourth chapter the tissues are considered in a "histology of *haliclystus auricula*" and in the several parts of the body—that is, "the umbellar and peduncular walls;" "histology of the tentacles;" "histology of the collectocystophores," (anchors;) "histology of the caudal disc;" and "histology of the digitali" and "the prehensile cysts," (nematocysts and colletocysts.)

This enumeration of the chapters and their sections will furnish to the naturalist an adequate idea of the mode of treatment of the subject as well as of the different organs and parts represented in the animals. It will suffice to add that the several parts are treated of in great detail, and are illustrated in eleven quarto plates from drawings by the author.

The plates for this memoir are in the process of being engraved, and the work will be published as soon as the funds of the Institution will permit. We have to regret, since the work was adopted by the Institution, that the author has been called from this life in the flower of his age and the promise of many days of successful devotion to science.

The next memoir accepted for publication, and which will probably form the whole of the twentieth volume of the Contributions to Knowledge, is by Joseph Jones, M. D., professor of chemistry and clinical medicine in the University of Louisiana. It gives the results of a very extended in-

vestigation of the military, religious, monumental, and organic remains of the ancient inhabitants of Tennessee. An appropriation was made to assist Dr. Jones in an exploration of these ancient remains, and to this work he has devoted an immense amount of labor. The results are presented in a volume which, after considerable abridgment, still consists of over 600 folio manuscript pages, requiring about two hundred wood-cuts and a number of plates for its illustration. The work was submitted to Dr. Otis, of the Army Medical Museum, who has given special attention to the subject of ethnology, and on his approval it has been accepted for publication. We think it is a valuable addition to our knowledge of the ancient races which have inhabited this continent, and well worthy of a place in the Smithsonian series of Contributions. The following extract is made from the preface by the author:

"The explorations and researches were commenced in the early part of 1868, and continued to the close of 1869. In the entire investigation, and in presenting an outline of the explorations and researches, I have endeavored to accomplish two results, viz: the accurate description of the aboriginal remains, and the collection of facts which bear in any manner upon the obscure history of the ancient inhabitants of this region. With the limited means at my command, and with numerous pressing professional duties and cares, I was unable to carry forward the explorations upon the scale which their importance appeared to demand, but it is earnestly hoped that these investigations, however imperfect, will be found an addition to knowledge which may serve as a point of departure for future explorers in this interesting field. They will not be without practical result if they should serve to form a basis for the comparison of the crania and works of art of the races of the stone-age of Tennessee and Kentucky with those of other parts of our country and of foreign climes."

The following is a brief abstract of the contents of the work:

Chapter I.—Inquiries regarding the name and history of the ancient race which inhabited in past ages the fertile valleys of Tennessee and Kentucky, called by early explorers the Chaöuanins.

Chapter II.—Ancient cemeteries. The so-called "mummies" discovered in caves. Mode of burial practiced. Stone graves. Inquiry into burial customs of the Indians.

Chapter III.—Mounds, fortifications, and earth-works.

Chapter IV.—Sites of aboriginal towns or encampments surrounded by earth-works. Description of contents of mounds. Indian traditions. Relations of early explorers and missionaries to the aborigines.

Chapter V.—Works of art, religious relics, sculptures, paintings, implements, weapons, vases, culinary vessels, idols, shell ornaments.

Chapter VI.—Crania of the mound-builders—comparisons with those from Mexico, Europe, &c. Discussion of the causes which led to the rapid depopulation of the American continent after its discovery by Columbus. General conclusions.

Another paper intended for the Contributions is on the Haida Indians of Queen Charlotte's Islands, by James G. Swan. These islands consist of a group in the Pacific Ocean, lying off the northwest coast of America, seventy-five miles northwest from Vancouver's Island, and at a distance from the main-land varying from sixty to a hundred miles. They are inhabited by a tribe of Indians who in manners and customs are somewhat different from the neighboring tribes on the main-land and from those of Vancouver's Island. In general appearance they resemble the natives of the northwest coast of Asia. Their distinctive features are apparent to the most casual observer. They are as a general rule of large stature, with better proportions and lighter complexion than the Selish tribe of Flatheads, inhabiting Washington Territory and British Columbia. This difference is particularly marked among the females. Those of the Haida tribe are tall and athletic, while the Selish women are shorter, with a greater tendency to corpulency. These people are especially distinguished for their carvings in stone and wood, and also for their tattooing.

The memoir is illustrated with drawings of specimens of these carvings, some of which are colored, and also with samples of tattooing, the latter copied by photography from the bodies of the Indians themselves. Some of the carvings represent posts or pillars placed in front of the houses of the chiefs, and are sometimes from 40 to 50 feet high. They are not intended as objects of worship, but as representations of the "toten" or heraldic insignia of the family occupying the house before which they are erected. As the house generally contains several families, the carving may be said to indicate the family names of all the occupants. It is important to state that these carvings have a general likeness to those found in Central America.

The paper will be an interesting addition to ethnology, as affording data for the comparison of the imitative art among the present and extinct races along the Pacific coast of America. It is by the author of the work on the Makah Indians, of Cape Flattery, published not long since by the Smithsonian Institution.

Besides the eighteenth volume of Contributions to Knowledge, the tenth volume of Miscellaneous Collections has been published. It consists of 913 octavo pages, and contains the following articles:

I. The Mollusks of Western North America; by Philip P. Carpenter, B. A., Ph. D., embracing the second report made to the British Association on this subject, with other papers; reprinted by permission, with a general index; pp. 446.

II. Arrangement of the families of Mollusks; prepared for the Smithsonian Institution by Theodore Gill, M. D., Ph. D., pp. 65.

III. Instructions for observations of thunder-storms, by Prof. Joseph Henry, p. 1.

IV. Circular relative to heights; by Prof. Joseph Henry, pp. 2.

V. Directions for constructing lightning-rods; by Prof. Joseph Henry, pp. 3.

VI. Queries relative to tornadoes; by Prof. Joseph Henry, pp. 4.

VII. Questions relative to the food-fishes of the United States; by Prof. S. F. Baird, pp. 7.

VIII. Memoranda of inquiry relative to the food-fishes of the United States; by Prof. S. F. Baird, pp. 5.

IX. List of the institutions, libraries, colleges, and other establishments in the United States in correspondence with the Smithsonian Institution, pp. 255.

X. List of Foreign Correspondents of the Smithsonian Institution, corrected to January, 1872, (fourth edition,) pp. 96.

XI. Check-List of Publications of the Smithsonian Institution, pp. 22.

The first article in this volume having not previously been described, the following account of it will here be properly in place. It is one of the series published by the Institution for facilitating the study of certain branches of the natural history of North America. It may be recollected that Mr. Philip P. Carpenter, a distinguished conchologist of England, when visiting the United States in 1859–'60, was engaged by the Institution to arrange and name the shells collected by the United States exploring expedition and those collected by other parties on the Pacific coast of North America. Mr. Carpenter had previously presented to the British Association a report on the Mollusks of the west coast of North America. On his return to England he made, to the same society, a supplementary report on this subject, embracing materials principally derived from the Smithsonian Institution. In order to facilitate the study of this class of animals by the American student, the reports in question and other materials have been reprinted from the stereotype plates of the British Association, kindly furnished the Institution for this purpose.

The propriety of this publication by the Smithson fund will be evident when it is stated that the materials on which it is founded are chiefly in the collection of the National Museum, under the charge of the Institution, and the report of the British Association forms a series of volumes which cannot be purchased separately, and are therefore inaccessible to the working naturalists of this country, to whom the work is more especially important.

"The principal object in preparing the works," says Mr. Carpenter, "is to collect and compare the writings of previous naturalists, so that it might be possible for students to commence where I leave off without being obliged to waste so large an amount of time as I have been compelled to do in analyzing the works of their predecessors." To render this work more useful an index has been prepared at the expense of the Institution, which, besides its importance to the general student of conchology, will be of special advantage to those who desire to study the specimens in the national museum. This work will be a valuable addi-

tion to the literature of zoology, and will fill a void in the descriptive history of the mollusca of this country. One of its chief merits is that in it are collected together from many sources notices of the labors of all previous investigators, and in many cases extracts of all that is important from their works. How much the publication of such monographs has tended to the advancement and acceleration of our knowledge of any group, the past history of zoology amply shows.

Another article in this volume not previously described is that drawn up by Professor Baird relative to inquiries as to the food-fishes of the United States. It has been used by him in his capacity of United States fish commissioner, but will be useful for reference to all who may be interested in this subject. The questions relate to the names, distribution, abundance, size, migration, relationship, food, reproduction, culture, protection, disease, capture, and value of fishes.

The circular on lightning-rods was prepared to save time in answering the frequent inquiries as to the best means of protection from lightning. On this subject it is proper to remark that the country is overrun with patented inventions for alleged improvements in lightning conductors. Most of these are founded on misconceptions of established principles of electricity, and although they may in most cases, if properly connected with the earth, serve to conduct a discharge which would otherwise be attended by serious consequences, harmlessly to the ground, yet they do not possess the character as to improvements which is claimed for them by their vendors.

The instructions for observations on thunder-storms originated in the desire to obtain special information as to the origin, direction of movement, and other facts relative to these interesting meteors, which are intimately connected with tornadoes. The latter phenomenon occurs, perhaps, more frequently in the United States than in any other country, and from the devastations which attend its progress over the surface of the earth, it becomes an object worthy of attention of the public generally as well as the professed meteorologist.

Another publication forming a portion of the Miscellaneous Collections is the third and completing part of a series of monographs of the Diptera, or two-winged insects, of North America, by Baron Osten Sacken, late of the Russian legation, and Dr. H. Loew, of Prussia. The first part was published in 1862, and included the families of *Trypetidæ*, *Sciomyzidæ*, *Ephydrinidæ*, and *Cecidomyidæ*. The second part appeared in 1866, and consists principally of a monograph of the *Dolichopodidæ*. The fourth part was issued in 1869, and embraces a monograph of part of the *Tipulidæ*. The third part, or that in question, includes the families of the *Ortalidæ* and *Trypetinæ*. In variety of forms, says the author, the family of *Ortalidæ* is scarcely surpassed by any other Diptera; at the same time it is hardly equaled by any in the structural differences occurring among the

individuals. Hence, it may be considered as one of the most interesting families of the order. Nevertheless, but little has been done as yet for the exact definition of its limits nor for its subdivision into smaller groups. It was, therefore, impossible to attempt a satisfactory description of the North American species of the *Ortalidæ* without first settling the question of the true limits of the family, of the relationship of it to other families, and of the character upon which it is established. This preliminary work the author thinks he has successfully accomplished, and presents his reasons for this in an introductory chapter, in which is reviewed what has previously been done on this point.

The *Trypetidæ* given in this part of the general work may be considered as a supplement to that published on the same family in the first part of the series. This supplement has been rendered necessary by the number of species of the family which have been found since the date above mentioned. At that period only twenty-three North American species were known. Since then the number has reached sixty-one, besides a number of species of previous authors of which information has since been procured. The author has, therefore, adopted the form of a supplement to his previous paper.

The following remarks in regard to the series, are by Baron Osten Sacken:

"As this will probably be the last volume of the present series of the publication of which I have the care, a few words with regard to the use and aim of these volumes may not be out of place here. The diptera, from the minuteness of their size and the extreme delicacy of the characters upon which their classification is based, are without any doubt the most difficult to study of all the orders of insects. To the general difficulty of the subject, the North American diptera add another one in their analogies with the European fauna on the one side and the South American on the other. At the same time the dipterological literature in the English language is not a rich one. The only eminent English dipterist, Mr. Haliday, published so little that his superiority was known to his correspondents much more than to the public in general. Other English publications which exist are utterly insufficient for any scientific purpose, and more apt to mislead than to teach. Now the volumes of the Monographs, although they embrace but an inconsiderable fraction of the whole dipterous fauna of this continent, show at least how the subject has to be treated, how descriptions are to be drawn, what characters have to be noted, what analogies with the European and South American fauna occur, and with what care they have to be studied in order to distinguish analogy from identity. Moreover, three of those four volumes are the work of the first dipterologist now living, who, after Meigen, may be considered as the founder of scientific dipterology. For all these reasons, I hope that the labor and expense bestowed upon these publications will, after a time, bring its fruit, although it may not be immediately."

Another article intended for the Miscellaneous Collections is a synopsis of American vespidæ, or wasps, by Professor De Saussure, of Geneva, translated from the original manuscript by Mr. Edward Norton, of Farmington, Conn. This work was commenced a number of years ago, but owing to the absence of Mr. Norton from the country and other causes of delay, it was suspended and has only been resumed during the last year. It will now be completed as rapidly as the corrected proof-sheets can be received from Switzerland. The character of the work is given in the following extract from the introduction, which also contains suggestions as to the philosophy of points of natural history well worth the attention of the general students of this branch of science :

"I propose in this volume not to give a general history of the wasps of America, but only to lay the foundations of the fauna of the *vespidæ*, principally of North America. I leave aside whatever concerns the habits of these insects, on which we have but insufficient information, and shall confine myself to speaking of them with respect to the genera or species which shall offer me some salient peculiarities. This work is not to be taken for a mere catalogue of species, of no further use than to satisfy curiosity. I think that modern zoology ought to tend toward another aim. The existence of species, the composition of fauna, their relations with the parts of the globe which they inhabit, are not merely accidental facts. In my opinion we must therein detect the last material and tangible manifestation of physiological forces, the study of which belongs to the domain of the highest natural philosophy. By him who adopts this view of the subject a far-searching study of species ought to be considered as one of the bases from which the search after the origin of species may start.

"It would seem that in zoology we ought to take for a starting point the actual existing forms in which life manifests itself, to ascend thence up to the primitive stock, just as in geology we start from the actual existing structure of rocks, and from the external configuration of the soil follow up the concatenation of the ancient events which have brought about as a last result the present state of the earth's crust.

"The study of species ought especially to serve as a means of revealing to us their variations and the affinities between them. These affinities point to a common relationship which is to be explained only by a direct filiation of the types. The study of forms, combined with that of their geographical distribution, comes afterward to throw light on the cause of the filiation which the graduated resemblances of the species seem to reveal to us. It shows that this filiation obeys laws which have also their regularity in so far as they are intimately connected with the physical laws which hold sway in every region of our globe.

"Toward these grand philosophical questions zoology ought in our time to tend, and species ought to be studied with a view to the solution of such questions. As in geology the study of the actual existing

state of the earth's crust and the appreciation of the phenomena that there take place, of the intimate transformation of rocks, of the mechanical destruction of the layers, of their reconstruction under new forms, allows us to draw an inference by analogy as to the more ancient transformations and the agents which have produced them; so the study of species and of their actual existing transformations seems likely to enable us to follow up the chain of these transformations to a point more or less close to their origin. The definition of the first divergences observable in the permanent varieties, which may be considered as *nascent species*, in order to ascend afterward to the relationship of species separated by the divergences more and more profound, such is, we deem, the point of view under which we should never neglect to study species.

"Zoology only when considered from this point of view is philosophical. It has not its aim in itself; it serves only as a means to sift questions of a higher order. Now, entomology is precisely the one of the branches of zoology in which the study of the filiation of species may become the most fecund in results, either on account of the multitude of ramifications of general types and of the multiplicity of forms under which each type appears, or on account of the smallness of the breaks which separate genera and species, or also on account of the immense variety of forms and of the facility with which species seem to become modified in proportion as they spread over the surface of the globe in following diverging ways. Thanks to all these causes, it is not difficult to find examples of every kind of filiation; not difficult, either, to follow over latitudes certain modifications still recent which allow us to draw an inference by analogy as to other modifications more profound because they are more ancient, and as to others of a degree still more advanced.

"Unfortunately in our times the greater number of entomologists have deviated too far from this philosophical path. They have turned entomology into a sort of amusement, which has for its object the discovery of new species; which loses itself in minutiæ, and at the bottom of which there exists no thought. Thanks to this tendency, collecting has ceased to be the means, and has become the object. In becoming an amusement entomology has gradually lost caste; it has fallen into the hands of dawdlers, and thus lost a part of its scientific character. This transformation has led men who aim at reaching an elevated rank in science to be too much inclined to withdraw from the field of entomology.

"As may be anticipated from what precedes, my intimate purpose in producing this work is to study the American fauna with a view to its origin. But this is a work of time which cannot be completed off-hand. The first thing to be done is to study carefully the species, to arrange them according to a good classification, and to describe, while proceeding, their affinities. That is the fundamental preparatory labor. I have not the pretension to overstep those limits in this monograph.

The knowledge of the American fauna is not yet advanced enough to allow us to draw with certainty an inference as to the affinities of the species between them so as to prejudge their filiation. However, I have made more than one remark on this topic, and I will hazard a few words on the matter when speaking of genera and species. But I reserve for another work the statement of comparisons which seem to me to cast some light on the dispersion of the vespidæ on the surface of the globe and on the modifications which have been worked off under diverse latitudes; in other terms, on the origin of actual existing faunæ.

"The complex affinities of species, and still more the filiations which arise from these affinities, become obvious to the eye only when one has acquired a perfect knowledge of the species and genera of a fauna. To seize them in all their extent, it is necessary to know, as it were, all the species of the group by heart in order to be able to take it in at a glance, or to examine at pleasure each part in the picture that one has formed in one's memory. Only when one has attained this point in the study of the group is it possible from the inspection of a species to feel its affinities, for they do not always appear in the more easily appreciable characteristics. They often discover themselves in certain characteristics of appearance which are, at times, of great importance, but which are not seized at a glance, or in certain relationships of form, which a long practice teaches one to distinguish easily, though they can scarcely be defined.

"The first basis of philosophical zoology is the profound knowledge of the detail of faunæ. To give an idea as complete as possible of the faunæ of the VESPIDÆ of America is the purpose of this volume.

"The plan which I have decided on, in drawing up this work, is the following:

"I give as far as possible the complete description of the species which belong to the fauna of North America, considering as such all those which people the new continent to the north of the Isthmus of Panama, including likewise the Antilles. This work is, therefore, more especially a monograph of the vespidæ of the United States, of Mexico, and of the Antilles. Besides, I have added, as a complement, the catalogue of all the species known till now in the rest of America, and I have found it a great advantage for the classification, the method becoming thus more complete. Moreover, this plan allows me to enunciate views on the geography of insects, on the dispersion of the species, and on the modifications which take place under the influence of diverse latitudes.

"I have confined myself, for the species of South America, to making a catalogue of them, not having materials sufficient for a monograph. For those, however, of which I had the types under my eyes, I have given Latin diagnoses, in order to present them in a comparative manner with respect to the surrounding species and also to complete

my previous studies of these insects, as well as to resume them and render their use more easy.

"I think myself bound to add here that as to my method of description, I describe as much as possible the species in a relative manner. Descriptions made in an absolute sense have always appeared to me less useful, because they insist on many useless characteristics and omit often the most important. The reader will not, therefore, be surprised at my not repeating, with respect to genera, the characteristics proper to every species or to the greatest number. In short, there are still other characteristics which I pass over, considering them rather useless, either on account of their constancy (such as the presence of silky hairs on the tibiæ) or on account of their variableness, such as the color of the lower surface of the abdomen.

"Descriptions are often made tedious by means of these superfluous indications and thus the essential characteristics are drowned in useless developments. In this way, precision is impaired instead of being increased. Doubtless, here again nothing is absolute. Certain isolated species may be sufficiently characterized by some salient traits, while others, surrounded by very closely connected species, require minute descriptions.

"Absolute and very detailed descriptions ought, in my opinion, to be employed when one describes a species isolatedly without knowing the most closely connected types, (for instance in the publications of geographical expeditions.) It is the monographer's duty to eliminate from these descriptions both the common-place and the useless. But in a monograph, the species are to be examined in a comparative manner and relatively to the adjacent types.

"The first condition of good comparative diagnoses resides in a wise co-ordination of the species which by way of exclusion may lead to choosing only between a small number of species. Though I do not like to find fault, I cannot, however, on this score, help complaining of the works in which the species, though described in an absolute manner, (that is by themselves and not comparatively with others,) are jumbled up together, without order, without division of genera, often in defiance of the most salient characteristics.

"Such works, got up in a hurry, the plans of which are laid down with a view to the convenience of the authors and not for that of the readers, cause the latter to lose much valuable time with no great result. They do not come up to the precision now required by the progress of science, and they are, therefore, behind their time. The reader cannot occupy his mind with incomplete works, nor can he waste his time in striving to find out species which are not to be found out; for there is no doing impossibilities.

"In most of my descriptions I have been especially attentive to the forms and characteristics of the form and marking, attributing to the color only a secondary importance, on account of its frequent variable-

ness. However, there is nothing absolutely fixed in nature; the forms and the marking, likewise, vary within certain limits. Therefore, the descriptions can only be averages deduced from a certain number of individuals.

"Theoretically, the description ought to represent, as it were, the algebraical formula of the species or its ideal type. It is not required that the description should tally with the individual, but, on the contrary, that it should represent the average of the characteristics of the ensemble of individuals. But in practice the description can never be so perfect, since it is drawn from a certain number of individuals and not from the ensemble of the individuals that represent the species. It is for the reader to know how to seize the connection that exists between the description and the even heterogeneous individuals which he may have beneath his eye. In a word, my method of description aims above all at generalizing, and requires that the reader should generalize likewise. It cannot suit much the amateur inclined to lose himself in a multiplicity of details, for whom the collection takes the place of nature, and for whom the determination of an individual is the final purpose of the study of a species.

"From the principles just laid down it follows that, in the extreme subdivisions of genera, I have usually preferred the characteristics taken from the form to those taken from the color. Undoubtedly it is less convenient for the reader, for the natural method is always less easy to follow than the empirical system; nevertheless I think that it is preferable to proceed in that wise, for whatever may be done to seek the natural method a large portion of empiricism is sure to remain, as I shall endeavor to show, in the study concerning the filiation of the species. We cannot, therefore, eliminate too carefully from classification, empirical elements.

"It is necessary to observe on this head that no absolute rule can be laid down as to the insubordination of characteristics. To be sure, forms varying less than colors, they offer, in general, characteristics more important than the latter; but there is, however, now and then a case in which the colors are more fixed than certain forms, and assume a real importance; for instance, as being the stamp peculiar to a certain geographical zone. Thus, the division *Hypodynerus*, (genus *Odynerus*,) which depends greatly on the colors and facies, and which comprises the most divergent forms. In this case the livery becomes the casket of a fauna, and is very important. In the succession of species it is generally observed that the colors vary much even when the forms remain fixed (or vary less;) but there are other cases in which it is color that remains stationary while the forms vary."

In the Smithsonian report for 1858, a paper was published on the method of *collecting and preserving insects*, prepared by Baron Osten Sacken, of the Russian legation, with contributions by other eminent entomologists, which has rendered valuable service in the way of

awakening an interest in entomology, and in facilitating the collecting of specimens. It was, however, not stereotyped; and as the methods of gathering and preserving insects have been much improved since the date of its preparation, it has been thought advisable to request Dr. A. S. Packard, jr., a leading authority on entomology, to furnish a new treatise on the same subject. In compliance with this request he has prepared a work corresponding with the present state of our knowledge. This work was published during the past year, and forms an octavo pamphlet of 58 pages, with 55 illustrations.

Two other articles, which will form parts of the eleventh volume of the Miscellaneous Collections, and will constitute a part of the series for facilitating the study of certain branches of natural history, are a continuation of works previously prepared by Dr. John Le Conte, of Philadelphia, on the North American Coleoptera, and published by the Institution. One of these consists of a description of new species of coleoptera, described since the publication of the first work on the same subject, and the other a supplement of the "Classification of the coleoptera of North America." The object of these works, as far as they relate to the genera of coleoptera, is to enable those who have a desire beyond that of merely collecting specimens to acquire sufficient information to enable them to consult with profit the various works in which are contained the descriptions of the species. The parts now printed comprise one hundred and forty pages, and will be followed by other supplements, descriptive of such other species as may be obtained from Smithsonian collaborators and other sources.

In the report for 1856, is given a plan by the late Mr. Charles Babbage, of London, of a series of tables to be entitled the "Constants of Nature and Art." These tables were to contain all the facts which can be expressed by numbers, in the various sciences and arts, such as the atomic weight of bodies, specific gravity, elasticity, specific heat, conducting power, melting point, weight of different gases, liquids, and solids, strength of different materials, velocity of sound, of cannon-balls, of electricity, of light, of flight of birds and speed of animals, list of refractive indices, dispersive indices, polarizing angles, &c.

The value of such a work, as an aid to original investigation, as well as in the application of science to the useful arts, can scarcely be estimated. To carry out the idea fully, however, would require much labor and perhaps the united effort of different institutions and individuals, devoted to special lines of research. Any part of the entire plan, may, however, be completed in itself, and will have a proportionate value to that of the whole. The Institution commenced about fifteen years ago to collect materials on several of the points of this general plan, under the direction of Professors John and Joseph Le Conte, then of the Uni-

versity of South Carolina, now of the University of California. The occurrence of the war, however, interrupted the work, which has not since been resumed until the present year, when an offer was made by Professor F. W. Clarke, of Boston, of a series of tables on *specific gravities, boiling-points, and melting-points* of bodies, compiled from the best authorities. This offer was accepted, and the work has been printed. It embraces all the reliable material in the English, French, German, and Italian languages on the foregoing subjects, with the exception of the specific gravity of solutions, for which reference is made to Storer's Dictionary of Solubilities, a work which will form part of the same general plan and ought to have been published by the Institution, but unfortunately at the time it was offered for this purpose our funds were not in a condition to defray the expense of printing. It has since been published as a private enterprise, and is highly prized by the working chemist.

Professor Clarke is still engaged on the same general subject, and proposes to extend his compilation of tables to include those of specific heat, conductivity of heat, thermal expansibility, and thermo-chemical equations for solids and liquids. This beginning we trust will induce other members of the corps of the Smithsonian collaborators to undertake other parts of the general plan of the constants of nature and art, to be published, from time to time, as they may be prepared. The work being stereotyped, the several parts can be finally combined and arranged as portions of a whole, whatever may be the order of their publication.

Among the "miscellaneous" publications during the year was the first lecture of the course founded by Dr. J. M. Toner, of Washington, by Dr. J. J. Woodward, assistant surgeon, United States Army, "*On the structure of cancerous tumors*, and the mode in which adjacent parts are invaded." In the report for 1872 an account was given of this fund established by Dr. Toner, the interest to be applied for at least two lectures or essays annually, relative to some branch of medical science, and containing some new truth fully established by experiment or observation. As these lectures are intended to increase and diffuse knowledge, they have been accepted for publication in the "Smithsonian Miscellaneous Collections."

It was stated in the last report that Congress had adjourned without ordering extra copies of the report for 1871. At the beginning of the next session, however, a resolution was adopted directing the printing, as usual, of 12,500 copies. An equal number of the report for 1872 was also ordered at the same session; 2,500 for the use of the Senate, 5,000 for the House of Representatives, and 5,000 for the Institution. This volume contains, besides the report of the secretary on the operations of the Institution for the year 1872, the report of the executive committee and journal of proceedings of the Board of Regents, the usual

appendix of scientific papers, communications, translations, &c., of special interest to the meteorological observers, teachers, and scientific correspondents of the Institution.

Among these articles is a lecture by Prof. A. P. Peabody, on the scientific education of mechanics and artisans; aboriginal trade and North American stone implements, by Chas. Rau; optical mineralogy, by Brezina; the troglodytes of the Vézère, by Paul de Broca; organic bases, by Bauer; boundary of geology and history, by Suess; phenomena observed in telegraphic lines, by Donati; nitrogen and its compounds, by Kletzinski; biographical notice of Lartet, by Fischer; eulogy on Ampére, by Arago; lecture on the meteorology of Russia, by Dr. Woeikof, and a large number of original communications relative to antiquities in various parts of the United States, &c. In this volume may also be found a full account of the Bache bequest, the Tyndall trust-fund for the advance of science, the Corcoran art-gallery, the Toner foundation, and the Hamilton bequest.

EXCHANGES.

The system of international exchanges, which has now been in operation for upward of twenty years, has been prosecuted during the last year with increased efficiency. It now includes 2,145 foreign institutions to which packages of books or specimens are sent and from which others are received. In the case of the system of exchanges, as in all the other operations of the Smithsonian establishment, the tendency is to an enlargement beyond the means at our command. Although, through the liberality of the several steamship companies, the packages are transmitted across the Atlantic free of cost, yet the expense of sending them to New York and from the sea-board to the centers of distribution in Europe, together with the payment of the several agents, has become so great that a much further extension of the system cannot be made without aid from other sources.

The system is, however, of so much importance, not only in rendering known what is done in the United States in the way of advancing literature and science to the world abroad, but also in diffusing a knowledge extensively through this country of the progress of science in the various parts of the Old World, that any check in its natural increase would be greatly to be deplored. It has, therefore, been suggested that an appeal be made to the various parties most interested in the continuance and enlargement of this system for a small annual contribution toward its future support and still more efficient management. Indeed, the benefit which the Institution is conferring, through this system, upon the parties most interested, appears in many cases to have ceased to be properly appreciated. They receive the advantages which flow from it as a matter of course, as they do those of the free air, and not as a gratuity

from the Smithson fund, the importance of which can only be properly appreciated by a deprivation of it for a short time. We infer this from the fact of the character of the complaints we frequently receive on account of accidental delay in packages reaching their destination, although in some instances the delay may have been occasioned by a want of proper directions on the part of the senders of the packages.

The centers of reception and distribution of European exchanges still continue the same as given in previous reports, viz: London, Paris, Leipsic, Amsterdam, St. Petersburg, Milan, with the addition of one at Brussels. The agency at London has for many years been in charge of Mr. William Wesley, whose fidelity and unremitted attention to the trust entitle him to an appreciative acknowledgment of the Board of Regents, and the same may be said of Dr. Felix Flügel, of Leipsic, and Mr. G. Bossange, of Paris. The center at St. Petersburg is under the charge of L. Watkins & Co., booksellers, and that at Amsterdam under Mr. Fred. Müller, who have efficiently contributed to the success of the enterprise in these countries. The center in Italy is under the charge of U. Hœpli, as agent for the Royal Institute of Milan.

The expense of transportation is very much increased by sending single packages separately, and therefore, whenever possible, without undue delay, economy is consulted by transmitting the exchanges at regular periods in larger numbers. Arrangements have been made so that invoices of packages are forwarded from this country at least once a month, except in the months of August, September, and October.

The following table exhibits the number of establishments in each country with which the Smithsonian is at present in correspondence:

Sweden	25	Turkey	11
Norway	23	Africa	18
Denmark	29	Asia	36
Russia	157	Australia	26
Holland	65	New Zealand	11
Germany	587	Polynesia	1
Switzerland	68	South America	33
Belgium	127	West Indies	11
France	257	Mexico	8
Italy	167	Central America	1
Portugal	21	British America	27
Spain	12	General	5
Great Britain and Ireland	412		
Greece	7	Total	2,145

As in previous years, the Institution has received important aid from various steamer and railroad lines in the way of free freights, without which the expense of carrying on the system would be far beyond the

means at command. Acknowledgment is again due for the liberality of the following companies:

Pacific Mail Steamship Company,
Panama Railroad Company,
Pacific Steam Navigation Comp'ny,
New York and Mexico Steamship Company,
New York and Brazil Steamship Company,
North German Lloyds Steamship Company,
Hamburg American Packet Company,
French Transatlantic Company,
North Baltic Lloyds Steamship Company,
Inman Steamship Company.
Cunard Steamship Company,
Anchor Steamship Company.

We present the foregoing list with much pleasure, not only as an acknowledgment of the liberality of the companies mentioned, but also as a very gratifying illustration of the high appreciation of the operations of the Institution.

LIBRARY.

The union of the library of the Institution with that of Congress still continues to be productive of important results. The Smithson fund is relieved by this arrangement from the maintenance of a separate library, while at the same time the Institution has not only the free use of its own books, but also those of the library of Congress. On the other hand, the collection of books owned by Congress would not be worthy the name of a national library were it not for the Smithsonian deposit. The books which it receives from this source are eminently those which exhibit the progress of the world in civilization, and are emphatically those essential to the contemporaneous advance of our country in the higher science of the day. The collection of books now in the library of Congress is over a quarter of a million, and, with the present rate of increase, in less than twenty years will be double that number.

To accommodate this immense collection, Congress has in contemplation the construction of a new building, and has authorized a commission to select plans and to supervise the location and erection of an edifice.

Statement of the books, maps, and charts received by exchange in 1873.

Volumes:		
Quarto, or larger	256	
Octavo, or less	633	
		889
Parts of volumes:		
Quarto, or larger	1,467	
Octavo, or less	1,407	
		2,874

Pamphlets:		
Quarto, or larger	326	
Octavo, or less	1,154	
		1,480
Maps and charts		454
Total receipts		5,697

Some of the most important donations received in 1873 are as follows:

From the Emperor of Germany: The fresco paintings of W. von Kaulbach in the interior stair-case of the Royal Museum at Berlin: 12 parts; imp. folio; oblong; 1853–1871. Schasler, (Dr. M.,) Die Wandgemälde Wilhelm v. Kaulbach im neuen museum zu Berlin; 1 vol., 4to. Schneider, Der Königliche Kronen-Orden; 1871, 4to. Schneider, Das Buch vom Schwarzen Adler-Orden; 1870, 4to. Schneider, Das Buch vom Eisernen Kreuze; 1872, 4to. Schneider, Das Verdienst Kreuz; 1872, 4to. Schneider, Die Kriegsdenkmünze für den Feldzug; 1870, 1871, 1872, 4to. Haack, Skizzen aus dem Feldzuge gegen Frankreich; 1870, 1871, 4to. Schneider, Der Rothe Adler-Orden; 1868, 4to. Hans Burghmaiers Turnier-Buch. Dürer-Album, Herausgegeben von W. v. Kaulbach and A. Kreling; folio.

From the Royal Academy of Sciences, Lisbon: 45 vols. and 12 parts; continuation of memoirs and other publications of the academy.

From the Catholic University of Louvain: "Annales," 10 volumes, 4to.; "Annuaire," 3 volumes and 17 theses.

From the government of Bengal: Descriptive ethnology of Bengal, illustrated by lithograph-portraits copied from photographs. Calcutta, 1872, 4to.

From the War Department, Vienna: 384 charts.

From Prof. Edward Morren, Liège: Bulletin de la Fédération des Societés d'Horticulture, 1860–1871, 13 vols.; Journal d'Agriculture pratique, vols. I–X; Bulletin de Congrès International de Botanique et d'Horticulture, 1865; La Belgique Horticole, 1871, 1872, &c.

From His Highness, Ismael I, Khedive of Egypt: Album du Musée du Boulaq, comprenant quarante planches photographiées par MM. Délié et Béchard avec un texte explicatif rédigé par Auguste Mariette Bey. Le Caire, 1871; folio.

From the National University, Athens, Greece: Catalogue of Ancient Coins; vol. 1, 4to. (Greek.)

From the University of Halle: 77 pamphlets; inaugural dissertations.

From the University of Greifswald: 70 inaugural dissertations.

From the University of Erlangen: 27 inaugural dissertations.

From Prof. K. Koch, Berlin: 50 inaugural dissertations.

From the Italian government, Rome: 41 volumes, 62 pamphlets, government publications.

From the government of Belgium: 16 volumes and 3 pamphlets, government publications.

From the Société de Géographie, Paris: Voyage d'Exploration in Indo-Chine, 1866, 1867, 1868; vols. 1, 2; atlas 1, 2, 1873; folio, and "Bulletin" for 1873.

From Mr. William Blackmore, London: Portfolio of photographs of some of the principal objects in the British Museum.

From Mr. Charles Harrison, London: Chaldean account of the deluge, from terra-cotta tablets found at Nineveh and now in the British Museum.

Among the donations of special interest during the past year is the photographic album of the museum at Boulaq, Egypt, containing forty folio plates with an explanatory text by Auguste Mariette Bey, printed at Cairo in 1871, and presented to the Institution by the Khedive of Egypt, through the application of Gen. Stone. This museum is situated on the borders of the Nile, near Cairo, and consists of a collection of all the antiquities that have been discovered of late years in Egypt.

After the immense number of antiquities which have been taken from that country to enrich all the principal museums of the civilized world, it is astonishing to observe how much remains, and how much by the enlightened munificence of the present ruler of Egypt has been preserved.

Ten of the plates of this album exhibit the statues of the Egyptian gods, nearly four hundred in number. The next division, consisting of seven plates, illustrates the funeral monuments. The next division is that of the civil monuments; these relate to their every-day life, their manners, customs, and arts. The next illustrates the historical remains. The last division is that of the Greek and Roman monuments.

Another work of great beauty and interest is that published by Mrs. Caroline E. G. Peale, the widow of Franklin Peale, of Philadelphia, as a memorial of her lamented husband. It consists of a series of beautiful photograph illustrations of specimens of the stone age of the human race, collected and arranged by Mr. Peale himself, with a catalogue and introduction, and a reprint of the various communications made by him to the American Philosophical Society.

This work is a valuable contribution to the ethnology of the United States. The photographs are among the best specimens of the art which have been produced in this country, and exhibit the specimens with such minuteness and fidelity as to serve to the student in archæology almost as a complete substitute for the specimens themselves. This work is truly a refined and intellectual tribute by an affectionate wife to the memory of her deceased husband—a tribute far more appropriate, and far more interesting to the public, than an unattesting monument of marble or of bronze. As human culture advances, the material mementos which only address the eye are replaced by those which are almost purely of an intellectual character.

METEOROLOGY.

In 1850 the Smithsonian Institution published an extended series of investigations in regard to the *winds* of North America, by Professor J. H. Coffin, of Lafayette College, Easton, Pennsylvania. In the production of this work Professor Coffin was assisted by the Institution in furnishing materials from its collections, and funds to defray the expense of the arithmetical calculations from the income of the Smithson bequest, the labors of the professor himself being gratuitous. Since the publication of this work, which has been largely made use of by the British board of trade in constructing its wind charts of the northern oceans, and by different authors in compiling and elaborating special treatises on meteorology, the Institution has continued to collect new materials in regard to the winds of the earth, and instead of elaborating from these a supplement to the previous treatise on the winds of the northern hemisphere, it was concluded to adopt the plan proposed by Professor Coffin of making a discussion of the winds of both hemispheres. The materials for this discussion are: First, all the observations reported to the Smithsonian Institution from 1856 to 1870; second, all those made at the United States military posts; third, all those at sea collected at the United States Naval Observatory by Capt. Maury; fourth, all those taken at sea in the Arctic and Antarctic regions; fifth, those at several hundred stations in other parts of the globe.

The greatest labor of the work was principally finished by Professor Coffin, when science and humanity were called to mourn the death of this most highly esteemed collaborator of the Institution. The continuation, however, of the tables was undertaken by the son of our lamented friend, Prof. S. J. Coffin, who has completed this work with that conscientious sentiment of filial reverence which well becomes the appreciative successor of so worthy a father. Very little, however, was finished by the elder Professor Coffin in the way of expressing, in general propositions, the results contained in the vast amount of numerical tables which he had elaborated. To supply this deficiency, fortunately, the Institution was enabled to avail itself of the assistance of Dr. Woeikof, member of the Geographical Society of Russia and late secretary of its meteorological commission, who, visiting this country for the study of its climatology, cheerfully undertook the required work. This gentleman is now engaged in adding the result of some new materials to the tables and in preparing the deductions from them for publication. The work, when finished, will do honor to the industry and scientific reputation of Professor Coffin and to the policy of the Smithsonian Institution.

The work of the reduction of *temperatures* has been prosecuted during the past year as rapidly as our means will permit. The labor, however, is very great, and consequently the work must be slow, unless a larger force be put upon it. The observations are not confined to those which have been made immediately under the direction of the Smithsonian Institution, but also include all those relative to North America which

have ever been published in this country or in Europe. But as these are made not only at different hours of the day, but also at different numbers of hours, to reduce these all to a fixed number of hours, and to deduce from them thus reduced the mean temperatures required, involves a far greater amount of labor than if the observations had been made in accordance with one system. It was to facilitate this reduction that the preliminary tables mentioned in the last report were constructed.

Complete tables have been prepared of temperatures for the following: Iceland, Greenland, British North America, Alabama, Alaska, Arizona, Arkansas, California, Colorado, Dakota, Delaware, Idaho, Indian Territory, Illinois, Montana, Nebraska, Nevada, New Hampshire, New Mexico, New York, Maine, Oregon, Utah, West Virginia, Washington Territory, Wyoming.

In addition to this work, tables showing the latitude, longitude, and mean annual temperature of all the stations in the United States were prepared for the Census Office.

It has been from the first a part of the policy of this Institution to devote its energies to no field of research which can be as well cultivated by other means; and the United States Government having established a system of meteorological observations, and having made liberal appropriation for its support, it has been thought, as was stated in the last report, for the best interest of the science to transfer the system of meteorological observations which has been so long continued by the Institution to that of the War Department, under the Chief Signal-Officer, General Myer.

The propriety of this transfer will be evident from the fact that the Institution has not the means of paying for printing blanks, postage, and the calculation and monthly publication of the results, especially since the assistance which has heretofore been rendered in this way, by the Department of Agriculture, is now discontinued; furthermore, General Myer can combine these observations with those made with standard instruments now under his charge, and out of the whole form a more extended and harmonious system than any at present in existence.

This transfer, which has just been made, we trust will meet the approbation of the observers generally, and we hope they will continue their voluntary co-operation, not with the expectation of being fully repaid for their unremitted labor, in many cases for a long series of years, but from the gratification which must result from the consciousness of having contributed to increase the sum of human knowledge. We trust also that the observers will continue to cherish an interest in the welfare and progress of the Smithsonian Institution, while, on our part, we shall in all cases, and at all times, be pleased to continue to answer any communication which may be addressed to us by them on scientific subjects.

We shall retain all the records of observations which have been accumulating at the Institution during the last twenty-five years, and continue the work of their reduction and discussion up to the end of the year 1873.

TELEGRAPHIC ANNOUNCEMENTS OF ASTRONOMICAL DISCOVERIES.

During the past year a very important arrangement has been concluded between the Smithsonian Institution and the Atlantic cable companies, by which is guaranteed the free transmission by telegraph between Europe and America of accounts of astronomical discoveries, which, for the purpose of co-operative observation, require immediate announcement.

Among such discoveries are those of planets and comets, or of bodies which are generally so faint as not to be seen except through the telescope; and which being in motion, their place in the heavens must be made known to the distant observer before they so far change their position as not to be readily found. For this purpose the ordinary mail-conveyance, requiring at least ten days, is too slow, since in that time the body will have so far changed its position as not to be found except with great difficulty; and this change will become the greater if the body is a very faint one, for in that case it could only be discovered on a night free from moonlight, which of necessity, in ten or twelve days, must be followed by nights on which the sky is illuminated by the moon, and all attempts to discover the object would have to be postponed until the recurrence of a dark night. Indeed, even then the search often proves in vain; and it is not, in some cases, until after a set of approximate elements are calculated and transmitted, that the astronomers on the two sides of the Atlantic are able fully to co-operate with each other.

These difficulties were discussed by some of the principal astronomers of Europe, and an application was made to the Smithsonian Institution, through Dr. C. H. F. Peters, of Hamilton College, New York, to remove them, by transmitting intelligence immediately through the Atlantic telegraph cable. For this purpose the Institution applied to the New York, Newfoundland and London Telegraph and to the Western Union Telegraph Companies to be allowed free transmission of this kind of intelligence, and it has received, through Cyrus W. Field, esq., and William Orton, esq., with that liberality which has always attended applications of a similar character by the Institution, the free use of all the lines of these companies for the object in question.

Similar privileges have been granted for transmitting the intelligence between the principal centers of astronomical research in Europe and the eastern ends of the Atlantic cables.

Although the discovery of planets and comets will probably be the principal subject of the cable-telegrams, yet it is not intended to restrict the transmission of intelligence solely to that class of observation. Any remarkable solar phenomenon presenting itself suddenly in Europe, observations of which may be practicable in America several hours after the sun has set to the European observer; the sudden outburst of some variable star, similar to that which appeared in *Corona borealis* in 1866; unexpected showers of shooting-stars, &c., would be proper subjects for transmission by cable.

The announcement of this arrangement has called forth the approbation of the astronomers of the world; and in regard to it we may quote the following passage from the fifty-fourth annual report of the Royal Astronomical Society of England:

"The great value of this concession on the part of the Atlantic telegraph and other companies cannot be too highly prized, and our science must certainly be the gainer by this disinterested act of liberality. Already planets discovered in America have been observed in Europe on the evening following the receipt of the telegram, or within two or three days of their discovery."

To carry out the proposition, the following arrangements have been adopted:

Center of communication in the United States:

1. The Smithsonian Institution, Joseph Henry, director.

Centers of communication in Europe:

1. Greenwich Observatory, Sir George B. Airy, astronomer-royal.
2. Paris Observatory, M. Leverrier, director.
3. Berlin Observatory, Prof. W. Foerster, director.
4. Vienna Observatory, Academy of Sciences, Prof. von Littrow, director.
5. Pulkova Observatory, M. Struvé, director.

Telegrams received at the Smithsonian Institution from observers in the United States will be forwarded immediately by Atlantic cable to Greenwich, Paris, Berlin, Vienna, and Pulkova, and thence by telegraph to other observatories in Europe.

Directions.—Discoveries made in Europe of new comets, planets, &c., will be announced without delay from Greenwich, Paris, Berlin, Vienna, or Pulkova by Atlantic cable to the Smithsonian Institution, and thence by telegraph to American observatories and the Associated Press.

The telegraphic dispatch announcing a discovery should be as brief as possible; and, after conference with astronomers, the following form has been agreed upon:

After the single word "planet" (or "comet") is given,

(1st) its right ascension in time, hours and minutes only; next, separated by the word

(2d) *north* or *south*, is given its

(3d) declination to the nearest minute.

In the case of a *planet*, in addition to the foregoing follows finally the magnitude expressed by the nearest ordinal number. In the case of a *comet* follows the word *bright* or *faint*, and it is well to add the direction of motion, requiring at the utmost two words combined, of S. W. N. E.; and also, if rapid, the quantity of its daily motion, the latter to the nearest whole number in degrees. For example, the following dispatch, "Planet twenty-three thirty-five north twenty-one forty-six eleventh," would be interpreted: A new planet is discovered in $23^h\ 35^m$ of right ascension and $+21°\ 46'$ of declination; eleventh magnitude.

Or a dispatch like the following: "Comet twenty-two forty-three north

sixty-five thirty-one bright southeast three," would announce the discovery of a bright comet in right ascension $22^h\ 43^m$; declination $+\ 65°\ 31'$; the declination decreasing, right ascension increasing, daily motion about three degrees.

The preceding examples contain the greatest number of words required for any one dispatch, if composed according to the rule adopted. Usually they will not exceed ten. Sometimes, however, the dispatch thus composed would become equivocal, and it has therefore been established as an additional rule that the number expressing the minutes of right ascension or declination shall always be expressed in words, even when zero occurs. Therefore, $23^h\ 0^m$ should be written "twenty-three nought," while "twenty three" will be understood to mean $20^h\ 3^m$. In a similar way 0^h of right ascension or 0° of declination are to be distinctly expressed by the word "*nought*."

The right ascension and declination in the dispatch will be understood to give the position (by proper motion approximately reduced) for the *midnight following* the date of the dispatch: Washington time for American discoveries, Greenwich time for European.

Since, in conformity with the preceding article, only an approximate estimate of a later position, and not that of the first observation itself, is given, the dispatch is not to be considered as a document for deciding the question of priority of discovery.

We trust the time is not distant when, with the completion of a telegraphic cable between Japan and the United States, this system will be extended to the eastern part of Asia, and the astronomers who are now in process of education in the United States, both from China and Japan, will be able to participate in the facilities thus offered for co-operation in the advance of astronomy. In connection with the publication of this circular, the National Academy of Sciences, at its meeting on the 15th of April, adopted a resolution recommending that amateur astronomers devote a portion of their time to sweeping the sky for the discovery of comets.

The following is a list of the announcements during 1873:

Discovery.	Date of telegram.	From whom.	Place.	Right ascension.	Declination.		Motion.	Magnitude.
	1873.			*h. m.*	° ′			
Planet	Feb. 18	Peters	Clinton, N. Y.	10 0	N.	13 40	N.	Eleventh.
Planet	May 26	Peters	Clinton, N. Y.	16 14	S.	21 18	W.	Eleventh.
Comet	July 5	Tempel	Vienna	0 7	S.	4 34		
Planet	July 14	Watson	Ann Arbor, Mich.	17 16	S.	21 43	N.	Eleventh.
Comet	July 27	Borelli	Marseilles	1 14	S.	7 32	S. E.	
Planet	Aug. 17	Watson	Ann Arbor, Mich.	23 2	S.	2 40	S.	Eleventh.
Comet	Aug. 21	Borelli	Marseilles	7 27	N.	38 45	S.	
Comet	Aug. 22	.....	Vienna	7 29	N.	36 55	S.	
Comet	Aug. 24	Henry	Paris	7 27	N.	59 30	E.	
Planet	Sept. 27	Luther	Düsseldorff	0 7	N.	7 53	S.	Tenth.
Comet	Nov. 11	Coggia	Marseilles	16 23	N.	27 26	S.W.	
Comet	Nov. 12	.....	Vienna	16 4	N.	22 6	S.W.	

NATIONAL MUSEUM.

The appropriation by Congress of $15,000 for the support and exhibition of the museum was continued last year. This appropriation, however, was scarcely sufficient to defray the expenses; but as Congress within the last two years had also granted $12,000 for heating-apparatus, and $25,000 for the fitting up with cases of additional rooms for the accommodation of the collections, a larger sum than $15,000 was not asked for the care of the specimens. During the last year a steam-heating apparatus has been introduced under the direction of Lewis H. Leeds, of New York, heating and ventilating engineer. The contract for the work was awarded to Messrs. Blake & Shotwell, of New York, who have faithfully carried out the plan adopted.

We regret to say, however, that the boilers, placed as they are in the middle of the length of the building, are scarcely sufficient in size to heat the extreme ends, and that during the coldest weather additional apparatus will be required. In the appendix is given a report of the engineer, with a plan of the several stories of the building.

The contract for making cases for the mineralogical department was given to John H. Bird, who has executed the work to the entire satisfaction of the Institution. The contract for constructing the cases for the large room of the upper story was awarded to James W. McKnight. These cases are of pine, veneered with walnut and bird's-eye maple, with large panes of English plate-glass, and are covered at the top and bottom with zinc to render them dust-proof. They are much more elaborately finished than museum-cases usually are, and this too at a much less expense than that of the various cases in other public buildings of this city. The plans and specifications of these cases, with a model case, were prepared by Prof. H. A. Ward, of Rochester, N. Y., with some modifications by Mr. A. Cluss, who has for several years been the architect of the Smithsonian building. The construction of the cases by Mr. McKnight was completed to the entire satisfaction of Mr. Cluss, the architect, not, however, without a complaint on the part of the contractor that his estimate of the cost of the work was far from being at a remunerative rate. The appropriation was sufficient to complete the cases, but not to furnish them with shelves. For this, an additional appropriation will be required. It is proposed to devote the large room, which is 200 feet long and 50 wide by 25 in height, entirely to ethnology, this being a branch of science attracting perhaps at the present time more attention than almost any other, and of which the illustrations at present in the general collection of the National Museum are nearly sufficient to fill the entire space and are rapidly increasing in number.

The appropriation of $15,000 for the care of the museum has provided for the employment of an additional assistant to take charge of the mineralogical collections. The person appointed to this position is Dr. F. M. Endlich, of Reading, Pa., who has lately completed his scientific

studies in Germany, at the Mining Academy of Freiberg, having paid special attention to the blow-pipe analysis of minerals. He has rendered efficient service not only in the arrangement of all the minerals of the museum, but in making up sets from the large number of duplicates for distribution to colleges and academies. Previous to the employment of Dr. Endlich, the duplicate minerals and geological specimens were sent to the School of Mines of Columbia College, New York, where they were examined and made up into sets for distribution, the minerals by Professor Egleston, and the rocks by Professor Newberry. In this line the Institution has done good service to the cause of education, and has the capacity of doing much more, provided the small amount of funds required for the purpose be granted by Government.

The appropriation of Congress has also enabled us to add a permanent taxidermist to the establishment, Joseph Palmer, from England, who has not only much improved the condition of the mounted specimens previously in the Institution, but, under the direction of Professor Baird, has added a large number of new specimens, especially a series of several hundred plaster casts taken from fresh fish and painted to represent the colored appearance of nature.

Few persons have any idea of the amount of manual labor necessary to properly sustain a museum in a condition fit for public exhibition. Heretofore, with the limited amount of money which could be expended from the Smithsonian fund, in addition to the $4,000 allowed by Congress, it was impossible to keep the specimens in the best condition either for critical study or for popular exhibition. The museum, therefore, although it has been an object of great interest to the public generally, has not been what we trust it will be in the future.

The following report of Professor Baird, of the additions to the museum, and the various operations connected with it during the year 1873, presents satisfactory evidence of prosperity.

Condition, progress, and operation of the National Museum during the year 1873.—"The record of the National Museum for 1873 is highly satisfactory, showing valuable additions from many parts of the world, and considerable progress in the way of reducing its contents to order, and making them serviceable to the cause of science. In no previous year has the number of distinct donations been so great, while the bulk of the parcels received has been almost inconveniently large. The total number of entries is 441, from 241 donors, and embraces 680 packages of different kinds, the similar figures for 1872 being 315, 203, and 544, respectively.

A list in the appendix will show in detail what has been actually received, including the names of contributors and the nature of their donations; the increase being in large part from the collections of different Government exploring expeditions, which by law of Congress are transferred to the Smithsonian Institution for safe-keeping, and also

from the contributions of special correspondents of the Institution, and by exchange. Nothing has been added in the way of direct purchases. While most large museums, such as the British Museum and those of Paris, Berlin, and Cambridge, Mass., &c., depend principally upon purchases for increasing their collections, the National Museum, without funds at its disposal for such purpose, has not yet felt the need of them; the collections received from the sources mentioned, free of cost other than that of mere transportation, being quite as great as the means of preparation and preservation will allow.

In addition to the number of donations, the entries in the record-books of the museum during the year 1873 will indicate approximately the extent and nature of the increase; the total number of entries during the year amounting to 10,604, or 33 per cent. more than those of 1872; the largest number, that of birds, amounting to 3,232 specimens; of fishes, 2,756; of ethnological specimens, 1,475; and of minerals, 941. This, however, does not represent accurately the number of separate specimens, as many objects of the same kind and from the same locality are often included under a single entry. Many additions during the year, especially of shells, minerals, and fishes, are yet unrecorded.

The total number of entries to the end of the year amounts to 187,453, filling thirty large folio ledgers. As might be expected, the principal sources of supply have been from American localities, the United States especially, although some objects of interest have been received from other parts of the world. The special object has been to bring together as complete an exhibition of the natural history and ethnology of America as the available means would permit. Should Congress at any future time decide to increase the scale of operations so as to enable the establishment to vie with such museums as those of London, Paris, Berlin, Vienna, &c., the framework of the present organization can be readily expanded so as to cover a much wider field. At present the available space for exhibiting specimens is occupied to its utmost extent, and but a portion of the collections actually within the walls of the Institution can be exhibited to the public. The remainder, however, are in such a condition as to be available for the study of specialists whenever they may find it necessary to examine them.

For the better understanding of the character of the collections received in 1873, a general sketch is given with reference to the regions whence they were derived, to be followed by an enumeration, in systematic sequence, of those of the most importance.

Of comparatively slight extent, yet perhaps of greater interest from their historic associations than any others, are the collections made during the eventful voyage of the Polaris, under Captain Hall, to the northern regions. This expedition, fitted out by the Navy Depart-

ment in pursuance of an act of Congress, left the United States in the summer of 1871, and succeeded in reaching the latitude of 82° 16′, the most northerly point ever attained by civilized man. Little was done in the way of collections until after the expedition went into winter-quarters in October, 1871; and most of the specimens gathered were secured during that winter and the following spring and summer. The death of Captain Hall interfered, of course, materially with the scientific work, but did not interrupt it, and at the time of the damage to the vessel by the ice, in October, 1872, very extensive collections had been made under the direction of Dr. Bessels, the chief of the scientific corps. These embraced specimens of the minerals, rocks, and fossils of Polaris Bay and other localities, large numbers of skins and skeletons of the musk-ox, (a great desideratum in public museums,) and other species of mammals, such as lemmings, seals, &c.; some birds and their eggs; many specimens of marine invertebrates, and a complete collection of the insects and plants met with by the party. Most of these collections were left on board the Polaris when the party remaining with the vessel went into quarters on shore during the winter of 1872–'73; and when the vessel was found to be unseaworthy, and it became necessary to build boats to move southward for the purpose of trying to meet the English whalers, it was found impossible to bring away more than a small number of the objects that had been gathered. Dr. Bessels, however, in the limited amount of space allotted to him, succeeded in packing a representative series of the fossils and rocks, and some specimens of insects, as also a few objects preserved in alcohol, all of which at present occupy a special case in the mineral-room at the west end of the Smithsonian building.

The absence of fishes in the collections of the Polaris party is very remarkable, no specimens of this class of vertebrates having been seen by the expedition in the northern portion of their journey, with the exception of a few small fishes in a fresh-water stream, which could not be caught, but were supposed to be young salmon. Cetaceans, too, were equally absent, the marine mammals being represented only by one or two species of seal.

Proceeding southward, the next region from which interesting material has been received during the year is that of the Pribylov or fur-seal islands of Behring Sea. Here the collections begun in 1872, on the island of Saint Paul, by Mr. Henry W. Elliott, assistant United States Treasury agent, were continued by him on the adjacent island of Saint George, and embraced a complete representation of the birds, especially the aquatic species and their eggs, the skeletons and skulls of the seals and some marine invertebrates. These are accompanied by very interesting sketches of the animal life of the island, especially of the seals and walruses, adding much to our knowledge of the habits of this interesting group of mammals.

The westernmost portion of the chain of the Aleutian Islands was thoroughly explored during the year by Mr. William H. Dall, while engaged in making a survey of the islands in behalf of the United States Coast Survey, his leisure time having been employed in securing a wonderfully complete series of specimens for the National Museum. These covered all departments of natural history, such as various mammals, birds and their eggs, insects and plants, and more especially marine invertebrates, of which it is believed that many new species have been obtained. A very prominent feature, however, in Mr. Dall's collections, consists in the extensive series of pre-historic objects obtained by the exploration of certain burial caves in Unalaska, which throw much light upon the past relationships of the Aleutians. Including the ethnological collections made by Mr. Dall during previous years, it is believed that no better illustration of the anthropology of that part of Alaska could be brought together than is now within the walls of the Institution.

A collection of carvings made by the Haidah Indians, of Queen Charlotte's Island, a tribe remarkable for their skill in this branch of art and for the variety and grotesqueness of their designs, has been received from Mr. J. G. Swan, whose contributions also embrace numerous ethnological and other specimens from Washington Territory, and is accompanied by a memoir, previously noticed in this report.

From Oregon we have a very remarkable collection of pre-historic remains, many of them of exquisite beauty of workmanship, consisting of arrow-points and pestles, bone-carvings, &c., presented by Mr. Paul R. Schumacher, of the United States Coast Survey.

Another valued addition from this part of the country consists of a number of specimens of the showt'l, both in skins and entire in alcohol, furnished by Mr. S. C. Wingard, the United States district attorney at Olympia. This mammal, the *Aplodontia leporina*, is like a muskrat, but with a very short tail, and although abundant in a very limited locality, is still little known to naturalists; while its peculiarities of form render it of great interest as an object of study. After many years of special effort directed toward securing a supply of these animals for the purpose of meeting some urgent calls, the object was finally accomplished by the aid of Mr. Wingard.

The coast of California has been well represented by the collections of Captain C. M. Scammon, of the United States Revenue Marine. This gentleman, an active and efficient officer of the service, has, in the interest of science, made use of the opportunities furnished by the necessary cruises along the coast, devoting himself especially to a careful scientific and practical study of the marine mammals, including the whales, porpoises, seals, sea-otters, &c. With commendable enterprise, he has commenced the publication, in California, of a large work on this subject, which, with its well-executed illustrations, promises to be a complete

treatise upon the whale-fishery and other similar interests on the Pacific Ocean, and one that will doubtless be a standard of reference in the future.

The collections made by Captain Scammon for his studies in this department have been transmitted by him from time to time to the National Museum, where they constitute one of its most unique and important features. Too much cannot be said in praise of gentlemen like Captain Scammon, who, in addition to the routine of their official work, labor for the advancement of science, and especially where such labor can be turned to practical account as in the present instance.

The United States steamer Tuscarora, under Commander G. E. Belknap, has been engaged during the summer in making soundings in the Pacific, from San Francisco toward the Aleutian Islands, with the object of determining the proper line for a cable between the United States and Japan; and numerous specimens of sea-bottom, with its microscopic *fauna*, were secured, and have been recently transmitted by Com. Ammen, of the Bureau of Navigation, in behalf of the Navy Department, with the request that the Smithsonian Institution would have them properly investigated and reported upon.

From the main-land of California collections have been received from Dr. J. G. Cooper, of San Francisco, Mr. W. A. Cooper, of Santa Cruz, and Dr. Hays, of Santa Barbara, consisting of specimens of birds, mammals, &c., of much interest.

By far the most extensive collections received by the National Museum during the year have been the result of Government expeditions in the regions west of the Missouri.

The first of these in geographical order, beginning at the north, is that of the survey of the boundary between the United States and the British territory, prosecuted under the auspices of the State Department, and under the direction of Mr. Archibald Campbell as commissioner. The proper determination of this boundary, in which Great Britain takes part, requires careful astronomical and geodetic work, this being conducted by Major Twining in behalf of the United States Engineer Department. The region traversed is one very little known, and the commissioner, therefore, as was the case during his survey of the western end of this line, took pains to secure the assistance of a competent specialist to make the necessary examination in regard to the natural-history resources of the country. Dr. Elliott Coues, assistant surgeon, United States Army, who has had much experience in similar duties, and who occupies a high rank as a naturalist, was chosen as surgeon to the scientific party, and succeeded, with the assistance given him by the commissioner, in making a very large collection of specimens in many branches of natural-history, and one especially rich in the department of ornithology.

The line surveyed during the year extended for several hundred

miles west of the Lake of the Woods, and will be continued in 1874, it is hoped, under the same auspices, to the summit of the Rocky Mountains or to the junction with the line which, in 1860, had been extended from the Pacific Ocean eastward.

The next Government expedition, in geographical position, was one sent out by the War Department to protect the exploring and construction parties of the Northern Pacific Railway, and placed under the command of Gen. Darius N. Stanley. This consisted of a very large force of men, some two thousand in all, as being necessary to protect the railroad parties against the threatened attacks of hostile Indians. Recognizing the propriety of utilizing so favorable a service in the interest of science, when it could be done at so trifling an expense, the Secretary of War authorized the appointment of a corps of naturalists for the expedition, and Mr. J. A. Allen was placed in charge of this, with several assistants. The expedition proceeded westward from Fort Rice to the Upper Missouri, and crossed some distance beyond the Yellowstone. The results of this expedition are very interesting, and would have been much more extensive but for the necessity of moving in constant apprehension of hostile attacks.

The geographical and geological exploration of the Territories, under Professor Hayden, furnished the next source of museum supply, the researches of himself and parties having extended over parts of Colorado and New Mexico. These furnished very large collections of fossil remains, of minerals and rocks, and of objects of natural history generally.

The exploration of the region west of the hundredth meridian, under the direction of Lieut. George M. Wheeler, of the United States Engineers, has also furnished a large mass of material, equal in extent and general character to that of Professor Hayden, the two parties together contributing a very large proportion of the general results of the year. Thousands of birds and hundreds of mammals, with tons of fossil and geological specimens, are counted in the aggregate received from these two expeditions.

From the explorations of Maj. J. W. Powell, in the cañons of the Colorado, most extensive collections have also been received; his survey being unique in the great extent and completeness of its ethnological representation. In these and the collections of the previous summer, the National Museum now owes to Major Powell's exertions a most interesting and extensive representation of the habits, manners, and customs of the Ute Indians, including every form of dress and personal adornment, of weapons of war and of the chase, of household and agricultural utensils, specimens of their food in different stages of preparation, and whatever else may throw light upon the habits and characteristics of one of the most primitive people on the American continent. A special feature of this collection is the number and variety of stone implements used for various purposes, properly mounted, and showing

the mode by which the knives and arrow-points are attached for every-day use.

New Mexico, Arizona, and Utah, are represented largely in the collections of Lieutenant Wheeler, and of Major Powell; and a collection of skins and eggs of birds, gathered in Southern Arizona, and presented by Capt. Charles Bendire, of the United States Cavalry, has also proved a very important addition to the treasures of the museum. Captain Bendire, while stationed near Tucson, embraced the opportunity to make complete collections of eggs of the Arizona birds, and among them are many previously unknown to naturalists. With commendable liberality, he has presented a series of these to the National Museum, which, from their beauty of preparation and rarity, constitute a very acceptable donation.

Among the collections received from the West must not be omitted: specimens of the salmon, trout, and other fresh-water fishes of the Upper Sacramento, gathered by Mr. Livingston Stone, deputy United States Commissioner of Fish and Fisheries. This gentleman has been engaged for two years on the McCloud River, near Mount Shasta, in obtaining eggs of the Sacramento salmon for supplying the rivers and lakes of the United States with this important food-fish, and he combined with his other duties the securing of material for a complete monograph of the salmonidae of the American continent. He has also furnished some interesting ethnological specimens.

The collections in the regions between the Mississippi River and the Atlantic, although from no one point of very great extent, have furnished a considerable aggregate, and are especially rich in objects of ethnology, to which special attention has been given during the year. The number of donations in this department is very great, and will be found recorded in detail in the accompanying list of contributions, the principal States represented being Michigan, Ohio, Indiana, Maryland, Rhode Island, Maine, &c.

Among the additions in other departments, we may specially mention the collection of fishes by Mr. James W. Milner, also an assistant of the United States Fish Commission, who has had special charge of ascertaining the character of the fish, and reporting upon the fisheries of the great lakes, and of the upper tributaries of the Mississippi. In connection with this inquiry, Mr. Milner secured a very complete collection of food-fishes of the lakes and of the Ohio River, which, in accordance with law, have been sent to the National Museum, and, it is hoped, will form the basis of a work upon the subject.

Having referred to the additions to the collections of the National Museum from the Pacific coast, we have to record also very important contributions from the labors of the United States Commission of Fish and Fisheries.

Of these full series are preserved in the National Museum for investigation, and the great number of duplicates gathered for that special

purpose are in the process of being made up into sets for distribution to colleges and academies throughout the country. No greater aid can be given to the cause of scientific education than to furnish such series as these; and accompanied as they will be by the report of the commission, in which these objects are fully and systematically described, they will be much sought after by institutions such as those referred to.

As in previous years, the facilities of the commission were eagerly embraced by scientific specialists, who spent a greater or less time with the expedition. Among these may be mentioned Mr. G. Brown Goode and Professor Rice, of Wesleyan University, Middletown; Professor J. E. Todd, of Taber College, Iowa; Professor Nelson, of Delaware College, Ohio; Dr. P. P. Carpenter, of Montreal; Mr. S. J. Smith and Mr. Thatcher, of Yale College, and many others on the United States steamer Blue Light, furnished by the Navy Department.

In addition to the collections made at Peak's Island, many interesting objects were secured under the commissioner's direction, by Dr. A. S. Packard, on the United States steamer Bache, which the superintendent of the coast-survey kindly supplied to the commission for a month, for the purpose of deep-sea exploration at points of the New England coast too remote for the services of the Blue Light. Mr. Vinal N. Edwards, an agent of the commission, at Wood's Hole, Massachusetts, also secured great numbers of fishes, several of them previously unknown to our waters.

Other collections of the coast-fishes of great interest were furnished by Messrs. Middleton, Carman & Co., of New York, including a species of perch, *Promicrops guasu*, taken in Saint John's River in Florida, weighing 750 pounds. A series of the Virginia coast-fishes was also received from Mr. Sibley, of Norfolk.

Mr. Samuel Powel of Newport, R. I., furnished some very rare species of fishes from Narragansett Bay. Others from Staten Island have been presented by Mr. Charles Copley.

In the completion of the account of collections received from the eastern coast of North America, we may mention specimens of the salmon family, as salmon, salmon-trout, and white-fish, from the United States salmon-hatching establishment, under the charge of Chas. G. Atkins of Bucksport, Me.; from E. M. Stilwell, fish commissioner of Maine; from Mr. J. B. Blossom, of Brooklyn; from Mr. Rutter of Frederickton, New Brunswick; and of capelin, from Mr. Delaney of Newfoundland. Of even greater interest than any of these, however, were specimens of a gigantic cuttle-fish, presented by Archibald Munn, of Harbor Grace, Newfoundland. For some years past there have been traditions of the occurrence of giant cuttle-fish, or so called "devil-fish," on our eastern coast, although the stories communicated in regard to them have been considered rather fabulous. During the year 1873, however, several well-authenticated cases have occurred, and in one instance an animal of this family attacked a fishing-boat by throwing two of its arms across it, which, however, the

occupants of the boat promptly severed with an ax, and the portions thus secured were brought into port. One of these pieces of an arm measured 18 feet in length, and it was estimated that an equal length remained attached to the body. An entire animal was afterward taken in a net, with arms about 30 feet in length. Another of a similar size was thrown upon the shore, near Harbor Grace in the winter of 1872–'73, the beak and suckers of which were forwarded to the Smithsonian Institution.

The collections from Mexico received during the year have continued to be of much importance, especially such as are covered by the contributions of Professor Sumichrast, who is a resident of the Isthmus of Tehuantepec, and has been for many years a valued correspondent of the Smithsonian Institution. From this gentleman we have received large numbers of birds, mammals, and reptiles, the object of most interest being the skeleton of the Mexican tapir, an animal until recently but very little known.

From Guatemala an interesting addition consists of a specimen of the ocellated turkey, presented by Mr. Sarg, being a species of great rarity, and very much superior in beauty to the wild turkey of North America.

A very noteworthy addition to the collection of the Institution was received from Prof. William M. Gabb, who has been engaged in exploring certain regions of Costa Rica, in the service of that government and of the Costa Rica Railway. This contribution contains many specimens illustrative of the habits and manners of the native tribes of Costa Rica, with a large collection of the birds, mammals, reptiles, fishes, &c., the whole forming a very full representation of the zoology and ethnology of that country.

Additional contributions, in the way of specimens of the natural history of the United States of Colombia, have been received from Gen. Stephen A. Hurlbut, late United States minister to that country, and from his son, Mr. George H. Hurlbut. To these gentlemen the National Museum previously owed the contribution of a skeleton of the tapir of the Andes, a species till then known only by a skull in the Paris Museum. The more recent donations consist of birds in great variety, and other objects.

Several collections have been received from more southern portions of South America, among them an interesting contribution of Peruvian antiquities, presented by Mr. W. W. Evans, and a stuffed specimen of the tapir of the Andes, from President Moreno, of Ecuador.

From the West Indies an important contribution consists in skeletons and alcoholic specimens of the fish of Cuba, presented by Prof. F. Poey, of Havana. Professor Poey is an eminent naturalist, whose writings upon the fishes of the West Indies are standard authority, and he has kindly undertaken to supply to the National Museum a complete series of Cuban fishes, properly named, to correspond with his own publica-

tions. Of these, over one hundred species have already been received, and others are hereafter expected.

The fishes of Bermuda are represented in a collection made by Mr. G. Brown Goode, in behalf of the Wesleyan University at Middletown, by which institution it was presented.

Other notable additions to the collection of fishes consist in specimens of the turbot, the sole, and the brill, of Europe, obtained through Messrs. Middleton and Carman, of New York, for the purpose of showing the relationship of these well-known food-fishes with our own. These specimens have been cast in plaster, and will shortly be placed on exhibition.

Quite a number of single specimens of various kinds have been received in exchange from European museums, although nothing specially noteworthy, with the exception, perhaps, of a collection of minerals from the salt-mines near Cracow, in Austria, presented by the University of Cracow, through Professor Att. Of contributions from other regions outside of North America, by far the most interesting representation is that of New Zealand, as furnished by the Canterbury Museum at Christ Church, in charge of Dr. Julius Haast. This embraces several complete skeletons of the giant fossil-birds of New Zealand, species, in comparison with which, the ostrich is but as a chick to a hen, a height of 15 feet, with other dimensions proportionate, being attained by several of the species. There is also in this collection a very good series of New Zealand birds and many specimens of ethnology in the form of implements of stone and bone, and other objects from the shell-heaps of the ancient Maori inhabitants, who were cotemporaries of the giant birds, (the moas,) and the remains of whose feasts contain fractured moa bones in great numbers.

Systematic summary.—Having thus given an account of the more important collections received during the year in their geographical relationships, a brief recapitulation by systematic arrangement may not be uninteresting.

The department of ethnology is one which has received the most varied and extended contributions during the year, due largely to the fact that special effort has been directed by the Smithsonian Institution in the way of circulars to correspondents, and otherwise, to induce the making of such collections, while in preparing instructions to the Government expeditions this subject has been dwelt upon particularly.

Reference has already been made to the prehistoric remains collected by Mr. Dall in Alaska, and by Mr. Schumacher in Oregon, and to those of more modern times furnished by Mr. Swan from Washington Territory and Queen Charlotte's Island, while the objects brought by Major Powell from the Colorado River, are of unusually great extent and value. Every State in the Union, however, has been represented to a greater or less extent in the form of stone-axes, pipes, pottery, &c. The

shell-heaps of Casco Bay were explored by parties connected with the United States Fish Commission, and those of Eastern Maine by Lieutenant Slamm of the Revenue Service. From foreign localities the most interesting contribution is that of the remains from the shell-heaps of the ancient moa-hunters of New Zealand, referred to as contributed by Dr. Haast. The interest of these localities is heightened by the fact that they embrace remains of the gigantic fossil *dinornis*, or moa-bird, proving that this was hunted and eaten by the Maoris.

Of the mammalia, a special prize has been a complete skeleton of the grizzly bear, killed by Lieutenant Carpenter, of Professor Hayden's expedition. Of this animal it is difficult to obtain good skeletons, and the one received was therefore especially acceptable, as it enabled the Institution to meet an urgent request on the part of the British archaeologists. Among sundry fossil bones of bears found in Great Britain and elsewhere in Europe, are remains which cannot be satisfactorily referred to any European animal; and it has been suggested that probably the American grizzly was at one time an inhabitant of Europe, and since then exterminated. The loan of this specimen to a committee of the British Association, charged with the investigation of the subject may enable them to determine this point. For its better illustration, however, the Smithsonian Institution added to the grizzly a specimen of the barren ground bear of the Arctic region, a very rare animal, and of which the only specimens preserved are in the museum at Washington. It is possibly the Arctic species, rather than the grizzly, which will be found to have the closest relation to the European fossil, or cave bear, in this respect exhibiting a parallel to the musk-ox, which once inhabited Central Europe, and after the glacial period was driven back to the northward by the increasing temperature of the continent, and finally entirely exterminated from the Old World. It is now only found living in America and Greenland.

Two very complete skins of the musk-ox, from Arctic America, have been forwarded to the Institution by Mr. William L. Hardesty, of Fort Simpson, and their arrival is expected at an early date. The collections of the remains of cetaceans, such as the skulls of whales and the skins and skeletons of porpoises, &c., from the California coast, as contributed by Captain Scammon, have been already mentioned; as also that of the *Aplodontia-leporina*, or showt'l, which has been received from Mr. S. C. Wingard.

To Professor Sumichrast, of Tehuantepec, the Institution owes the contribution of a skeleton of the tapir of Mexico.

A complete series of the mammals of Costa Rica and their skulls, furnished by Professor Gabb, is of great value.

Among the rarest of mammals is included the hairy tapir of the Andes, from South America, the only representative of the species heretofore being a skull in the Paris Museum.

To the Hon. S. A. Hurlbut, at the time United States minister to

Bogota, and to his son, George H. Hurlbut, the Institution owes the first complete skeleton of this animal ever obtained; and during the year 1873 it received a mounted skin, presented by President Morèno, of Ecuador.

The Museum of Comparative Zoology at Cambridge has furnished, in exchange, casts of several crania of mastodons.

Among the most important contributions in the way of mammals are the specimens received from Mr. P. T. Barnum, consisting of animals which have died in his extensive menageries in different parts of the country, and transmitted to the National Museum from time to time by his agents, in compliance with his instructions. Among these may be mentioned a Malayan tapir, a Bactrian camel, a dromedary, an African panther, the Florida manatee, the Indian rhinoceros, the mandrill and other species, all of them of extreme interest, furnishing both skeletons, and skins fit for mounting.

Of birds the most important collections are those from the Aleutian Islands, received from Messrs. Dall & Elliott, and from the region west of the Missouri, from the different Government expeditions already enumerated. Dr. Haast has also supplied many rarities from New Zealand. A special acquisition is that of the ocellated turkey from Honduras, presented by Mr. Sarg. This is extremely rare in public museums, with a market-value, for a good skin, of about $200.

Other notable contributions are the skin of two species of tern or mackerel gulls, one the *Sterna longipinnis*, from Portland, Me., by Mr. Franklin Benner, and the other *Sterna leucoptera*, from Wisconsin, presented by Dr. T. M. Brewer, both of them the first specimens of their respective species hitherto detected in North America.

A collection of eggs of birds from Arizona, by Captain Bendire, has also been referred to, and is of special value.

Comparatively few reptiles have been received during the year; these consisting mainly of specimens brought in by the Government expeditions. We may, however, mention several valuable species from the Isthmus of Tehuantepec, sent on by Professor Sumichrast, and from Costa Rica by Professor Gabb.

The list of fishes is very extensive, composed mainly of those brought in by the United States Fish Commission. These embrace a very great variety, including specimens of sharks, rays, and many notable fish secured on the coasts of Maine, Massachusetts, Rhode Island, &c., as well as of sea salmon, lake salmon, white-fish, smelts, capelin, and other varieties from the waters of California, the Great Lakes, the Eastern States, and the provinces. Many fishes were brought in also by the Government expeditions, and some have been received from Costa Rica through Professor Gabb, and several interesting species from Europe, through Messrs. Middleton & Carman, of New York.

Of special interest in connection with the study of the fishes of the United States, is a series from Cuba, contributed by Professor Poey, of

Havana. This gentleman has contributed more than two hundred species, and others have been promised.

The fish of Bermuda, collected by Mr. Goode, also tend to complete the list of the Atlantic species. Dr. John Edward Gray has presented a large number of species of fish, particularly from the Indian Ocean.

Of the fishes from the interior of of the United States, collections have been made of most of the prominent kinds by Mr. James W. Milner, of the United States Fish Commission, while Mr. George Spangler, of Madison, Indiana, has furnished specimens of the paddle-fish, shovel-headed sturgeon, and other conspicuous varieties.

Of marine invertebrates, such as star-fishes, shells, crustacea, worms, &c., immense numbers were gathered by the fish commission on the eastern coast, and extensive series have also been supplied by Mr. Dall from the Aleutian Islands.

Many plants have been received, including a small but very interesting collection made by the Polaris party in high northern latitudes. In accordance with an arrangement entered into between the Smithsonian Institution and the Agricultural Department some years ago, the plants and insects received at the National Museum are turned over to the last-mentioned establishment for proper care, as rapidly as is consistent with the duty of securing reports upon those collections made by the Government expeditions.

In a similar manner human crania received are turned over to the Army Medical Museum, the object in both cases being to avoid dividing series, by combining all the specimens of the same general class in some one of the various Government establishments in the city.

The collections in paleontology, mineralogy, and geology, as already mentioned, are of great magnitude, and alone have filled many hundred boxes. These represent the most important results of the Government exploring expeditions.

It will be seen, from what has been already mentioned, that the collections made during the year represent an enormous aggregate of material, and one requiring the utmost exertions of the limited force connected with the National Museum, for its proper treatment. Of course a strict record must be kept of everything received; and when the packages are opened and the contents assorted, the work of registering and recording begins. Sometimes this requires the identification of the species; and even the mere manual labor of numbering and labeling every specimen, and marking the corresponding record in the registry-book, is one of very great magnitude.

After the respective collections have been properly investigated, and in many cases elaborate reports written concerning them, the selection of a reserve series for the Museum begins, which are then either placed upon the shelves or packed away for future treatment. The duplicates, which constitute a large percentage of the whole, are set aside for ex-

change with other museums or for distribution to educational institutions.

Special effort is directed on the part of the Smithsonian Institution toward carrying out this feature of the plan in the most thorough manner; and while the distribution thus made in 1873 has been very extensive, that for 1874 will be even greater still.

It is in this particular feature that the National Museum of the United States differs from almost any other in the world, excepting, perhaps, in a single direction only, the Government Geological Museum at Vienna.

In most other museums single specimens only of objects are offered or accepted, especially of such as are new to the cabinet, the labor of digesting the results of great expeditions being accomplished under other auspices, no plan being adopted to utilize any surplus, in any other interest than that of the establishment itself. The British Museum, for instance, which stands at the head of all institutions of this kind, never parts with a duplicate, and is oppressed by the weight of its surplus material, even though in small proportion to the reserve collection.

It is a question whether any museum in the world is in receipt of so great an amount of material as the National Museum at Washington; and were the rule of the British Museum to prevail it would be crushed by the weight of its own riches. The constant effort, however, on the part of the Smithsonian Institution to utilize this material in the interest of science and education, tends to keep down the mass, though it is only at the expense of the incessant activity and constant labor of the Museum force that this object is in any measure accomplished.

In most public museums there is a corps of specialists whose business it is to supervise all the collections received, the British Museum having a large force of such officers. The funds available for the National Museum of the United States do not authorize the appointment of such officers, although some of the present assistants are prominent specialists in certain branches. In order, therefore, to secure the prompt determination of the material received, and the consequent speedy disposal of the duplicates, the offers of assistance from eminent scientists, so frequently made, are gladly accepted, and the material placed in their hands for investigation. During the year this labor has been performed, always gratuitously, by a number of gentlemen, among whom may be mentioned Prof. E. D. Cope as employed in the investigation of the fossil mammals; Dr. Coues, Mr. J. A. Allen, and Mr. Ridgway on that of the birds; Professor Cope, of the reptiles; Dr. Gill, Professor Goode, and Mr. J. W. Milner, of the fishes; Mr. P. R. Uhler, Mr. William H. Edwards, Dr. A. S. Packard, Mr. Cyrus Thomas, and Dr. L. Le Conte, of the insects; and Mr. William G. Binney and others, of the shells.

Professor Verrill has undertaken the determination of the collection of marine invertebrates obtained from the waters of the east coast of the United States, with the assistance of Mr. S. J. Smith, Dr. Packard,

Professor Hyatt, and other gentlemen, while Prof. D. Eaton has identified the marine plants. To these gentlemen, the thanks of the Institution are due for their extremely valuable services in the connection referred to.

On the transfer of the large number of ethnological objects from the lower hall and the connecting range to the new room in the second story, much space will be gained for the re-arrangement of the zoological collections, and an opportunity will be given for introducing many species which are now necessarily kept elsewhere, for the want of accommodations. It may, however, be proper to state that for the exhibition of the full series of objects now in possession of the Institution, and not including any unnecessary duplicates, much ampler accommodations will be needed than can be had in the building, and if these are to be displayed as they should be it will be necessary at no distant day to provide means for extending the space, either by a transfer of the entire collection to new buildings or by making additions to that of the Smithsonian Institution.

In illustration of this statement, it may be remarked that, of sixty-seven thousand specimens of birds entered in the catalogues of the museum, and of which more than forty thousand are on hand, (the remainder having been distributed,) less than five thousand are mounted and on exhibition, these occupying fully two-fifths of the present hall; the rest are preserved as skins, in chests, drawers, and boxes, and of them fifteen thousand, or three times the number at present on exhibition, require to be displayed for the proper illustration of even American ornithology.

The urgency for additional room is still greater for the mammals. Here, out of some five or six thousand specimens, less than so many hundred are exhibited, the remainder alone being almost sufficient to occupy half of the hall. Of many thousands of skeletons of mammals, birds, reptiles, and fishes, a very small percentage is shown to the public, while exhibition-room to the amount of thousands of square feet is required for specimens that now occupy drawers in side apartments.

Of the very large collection of alcoholic specimens, which constitute the most important material in every public museum, scarcely anything is on exhibition, although the selection of a single series for this purpose is very desirable.

The new ethnological gallery, already referred to, even now is scarcely adequate to accommodate a complete series of the ethnological specimens on hand, without taking into consideration the number that the explorations of the past few years may lead us to expect for the future.

It is, however, very gratifying to be able to state, that if the proper plan of a national museum for the United States should be to make it an exponent of the ethnology, and of the animal, vegetable, and mineral treasures of America, this can be considered as in a great measure already accomplished, especially for North America, and to a very con-

siderable degree for the middle and southern portions of the New World. All that is now required by the Institution for the presentation of such a series is proper accommodations and the means necessary to prepare and exhibit the same.

With the vast number of duplicates on hand it is always easy to secure, in the way of exchange with foreign collections, nearly all the objects desired from other parts of the world, and it will probably never be necessary to ask for funds, to any extent, to secure such articles by purchase—an expense which constitutes the principal outlay of most foreign museums.

Mineralogical Collection.—The following is an account of the mineralogical department, by Dr. F. M. Endlich, who has charge of this branch of the museum:

The mineralogical department of the United States National Museum (placed by Congress under the charge of the Smithsonian Institution) comprises four divisions:

I. Mineralogy.
II. Lithology.
III. Ores.
IV. Metallurgy.

The collection of minerals occupies twelve cases, and numbers upwards of 3,000 specimens, belonging to 230 species. These minerals are collected from all parts of the globe, obtained to a considerable extent from the United States Government expeditions, and by exchange and donations. Dana's system of mineralogy has been chosen to serve as a basis for the arrangement of the different species and groups, and, in order to render the collection of use to the visitor or student, a very elaborate system of labelling has been adopted. Every specimen, unless too large, is placed in a paste-board tray, which contains, at the same time, a label giving the name of the mineral, the chemical composition, crystalline form, if any, locality, and the name of the donor. At the beginning of each species in the continuous row is placed a printed "species-label," giving the name and chemical composition, and distinguished from the rest by a red border. To the front edge of its tray every specimen has attached a printed label with black border, showing the name and locality. In case the mineral is not contained in a tray this label is placed in some conspicuous position near it. The printed labels are so distributed as to be easily read by the visitor, at the same time disposed in such a manner as not to obstruct the view of the specimen. Large printed "division-labels" are placed at the head of each of the six divisions adopted by Professor Dana.

This system of labelling will enable the student to see at once the name, composition, and locality of any mineral, and will show him its position in the adopted system of classification. Besides these precautionary measures, to preserve the history of every individual specimen, a number is written on every specimen, corresponding to one in the mineral record, in which the labels are entered.

Several very rare and valuable specimens of meteoric iron and other minerals are contained in the collection. In the appendix is given an alphabetical list of species at present represented in the museum. The enumeration of the species is based upon the catalogue of minerals published by the Smithsonian Institution in 1863.

The lithological collection occupies thirteen cases, and comprises about 2,300 specimens. Of the various species and variety of rocks thus far known and described the greater part is represented. An arrangement has been temporarily adopted by which the specimens are arranged according to their collector, at the same time, however, retaining a certain lithological classification. A large quantity of these specimens has been brought in by the expeditions exploring the Western Territories, and thus a very valuable and unique collection has resulted.

A full suite of Saeman's (Paris) rocks is contained in the collection, besides a suite from Freiberg, Saxony, and other European specimens. Eventually the collection is to be arranged according to locality, following, within these bounds, some definite lithological system. A system of labeling analogous to that adapted for the minerals will be introduced. The size of the lithological specimens is that of similar ones in a large number of European collections—3 inches by 4 inches—giving the collection a pleasing, uniform appearance, and facilitating the arrangement.

Three cases are occupied by the collection of ores, which comprises about five hundred specimens. The object of this collection is to present a characteristic specimen of ore from every worked lode in the Western States and Territories. Every year comparatively large additions are made. These ores are labeled, giving the name, the value as ore, (if known,) the name of the mine, its locality, and the name of the donor. If this collection be completed successfully it will prove to be a very valuable addition to the mining statistics, and will justly illustrate the mineral wealth of the United States.

A collection of metallurgical products has been organized, proposing to show the ores, fluxes, slags, raw and commercial products, illustrating the various processes in operation in the United States and other countries. As yet this collection is small, but it may be hoped that as soon as its existence and object becomes more generally known, the necessary contributions of specimens will not be wanting.

Besides these collections, representing typical specimens, the museum contains a very complete and handsome series of the geyserites and other similar deposits from the United States National Park. Series illustrating various localities famous for their yield of minerals, such as Wieliczka, in Polish Austria, Girgenti, in Sicily, and others, have been obtained. The mineralogical and geological material collected and rescued by the North Polar Expedition, under the late Captain Hall, forms one of these interesting suites.

Altogether there are upward of 6,300 specimens on exhibition; over 800 are on hand, to be incorporated during the present year, and almost daily new material swells the collection.

In connection with the mineralogical department is the mineral exchange. A large number of mineral duplicates, upwards of 10,000, is on hand, and these, having been classified and arranged in series, will be distributed to institutions of learning or disposed of in exchange in order to increase the main collection. A limited number of good duplicates is kept on hand—deposited in drawers—to serve for foreign exchange and to afford material for study, should it be required.

Photographs of antiquities in the British Museum.—Among the additions to the museum is a series of photographs of the most valuable contents of the British Museum, systematically made and arranged with the definite object of showing man's gradual advance and the development of civilization from pre-historic to mediæval times. These were made by S. Thompson, with the consent of the trustees of the museum, for W. A. Mansell & Co., of London, as proprietors, and have in part been presented by them to the Institution. The series consists of nearly a thousand plates and is grouped in seven parts:

I. Pre-historic and ethnographical series.
II. Egyptian series.
III. Assyrian series.
IV. Grecian series.
V. Etruscan and Roman series.
VI. Antiquities of Britain and foreign mediæval art.
VII. Seals of sovereigns, corporations, &c.

They will be placed on exhibition at the Institution in the large hall as soon as the cases are prepared to receive them. These photographs are a valuable contribution to the means of diffusing a knowledge of the largest ethnological collection in the world, and will serve as original materials for the use of the historian, scholar, and art-student. The publication of a work of this magnitude has necessarily caused an enormous outlay, and the proprietors are obliged to seek the support of men of culture, for whom it has been prepared. It gives us pleasure to recognize the importance to art and science of this new application of photography, and to recommend it to public institutions and gentlemen of fortune. It is not necessary to point out how valuable such a work would be to any library or museum, particularly in a country where but few can have the opportunity of seeing and still fewer that of studying the originals represented.

CORRESPONDENCE.

An immense amount of labor is every year devoted to correspondence, which includes subjects relating to almost every branch of human

thought. Among the communications are many which relate to supposed scientific discoveries and proposed new theories of the physical phenomena of the universe.

There exists, especially in this country, in which there is a greater amount of popular diffusion of scientific knowledge than in any other, a class of persons who, without previous scientific training, attempt to solve the most difficult problems of general physics. Among these are men of considerable literary culture and much general reading, but wanting in the special kind of logical and mathematical training necessary for successful scientific investigation, they dissipate a large amount of mental energy in unproductive speculations. The correspondence with this class of persons is not only very onerous, but difficult to manage, inasmuch as the rejection of their propositions is generally attributed to prejudice or a kind of scientific oligarchy. The general method which has been adopted for dealing with them is to insist upon their deducing from their hypotheses some new results which can be immediately verified by experiment and observation, as a test of the value of their speculations. This demand is made on the ground that any hypothesis of value must not only explain what is already known, but must also lead to results which have not previously been observed.

Another class of correspondents write for information as to scientific principles on which to found inventions for special purposes. Among this class we have had within the last few years a large number of gentlemen of intelligence in the Southern States, who seek to retrieve fortunes lost in the war by inventions which may become remunerative through the sale of privileges for using them. Unfortunately, in most cases the problems they essay are of too expensive a character to be brought to the test of experience without the outlay of a large amount of money, and frequently of too indefinite a conception to warrant success even under the most favorable circumstances. The most remunerative inventions are those of very simple character, and of general use, such as a sewing-machine, rather than a steam-engine.

Another class of correspondents consists of those who ask for the information as to minerals, plants, and other objects of natural history. In the answers to these the Institution has done great service in the assistance of students, and in the diffusion, unostentatiously, of a large amount of knowledge.

In carrying on the correspondence and other parts of the general operations of the establishment, much assistance has been rendered by the collaborators of the Institution, among whom, during the past year, our thanks are due to Prof. S. Newcomb, Prof. W. Harkness, and Prof. Asaph Hall, of the Naval Observatory; Prof. J. E. Hilgard, C. A. Schott, and Prof. William Ferrel, of the Coast Survey; Dr. Woodward and Dr. Otis, of the Army Medical Museum; Prof. J. P. Lesley and W. E. Dubois, of Philadelphia; Prof. W. D. Whitney and Prof. J. D. Dana,

of New Haven; J. H. Trumbull, of Hartford; Prof. F. L. O. Roehrig, of Ithaca, New York; Dr. Henry Wurtz and Prof. Raymond, of New York; Dr. L. D. Gale, Edw. Clark, esq., W. Q. Force, Prof. C. Abbe, of Washington, and others, especially in natural history, mentioned in connection with the operations of the museum.

WORK DONE IN THE INSTITUTION AND IN CONNECTION WITH OTHER ESTABLISHMENTS.

The Secretary, in addition to the general direction of the scientific operations of the Institution, has continued during the past year his investigations in regard to fog-signals and other aids to navigation, and has discharged the duties of chairman of the Light-House Board, visitor to the Government Hospital for the Insane, president of the National Academy of Sciences, and trustee of the Corcoran Art Gallery.

Professor Baird, the assistant secretary, in addition to the arrangement of the materials received by the museum, making up duplicates for distribution, and the general direction of the system of exchanges, has continued the duties with which he was charged by the President of the United States in accordance with the law of Congress, namely, that of prosecuting an inquiry into the present condition of the fisheries of the coast and lakes, and the suggestion of methods for their improvement. As in 1871 and 1872, he spent the principal part of the summer season in carrying on his mission. He established himself on Peak's Island in Portland Harbor, where, with a large force of volunteer naturalists, he was engaged from July until October.

The law of Congress under which his work is carried on directs the departments of the Government to render him all the aid in their power, and in pursuance of this the Secretary of the Navy placed at his disposition the United States steam-tug Blue Light, under Commander L. A. Beardslee, United States Navy, properly fitted for her purposes and provided with all the apparatus necessary for deep-sea research; and with the co-operation of Prof. A. E. Verrill, an eminent zoologist of Yale College, his associate in this work, he succeeded in solving many of the problems of the inquiry, as well as in securing at the same time a great amount of material in the way of specimens of marine animals for the National Museum, embracing a very large number of species, among them numerous forms entirely new or previously unknown on our coast.

In addition to the examination and classification of the minerals which have been received at the Institution, and making up sets for distribution, Dr. Endlich has made a qualitative examination of a large number of specimens of minerals which have been submitted for that purpose to the Institution. For purposes of education the Institution furnishes qualitative determinations of mineralogical specimens, but in no case will it undertake to furnish percentages of the different components of

specimens, or give certificates for commercial purposes of their value. In regard to work of this class, the following rules have been adopted:

1. All applications for the examination of specimens must be made by letter, addressed "Secretary of the Smithsonian Institution."

2. The specimens examined, or a part of them, will be retained by the Institution.

3. All specimens are to be delivered to the Institution free of expense.

Mr. Meek, who still retains his connection with the Smithsonian Institution, has continued during the past year his palæontological investigations relative to the specimens collected by various State and General Government surveys. He spent last summer in Colorado in the investigation of the geology of the region, returned to Washington in October, but on account of the weak condition of his lungs he thought it prudent to spend the present winter in Florida, carrying with him a part of his library and a series of specimens with which to continue his work.

Dr. Theodore Gill, who has special charge of the Smithsonian deposit in the Library of Congress, and devotes his extra time in the Institution to natural history, has been engaged during the past year in the study of the vertebrates generally, the results of which have been partially published in a memoir on the number of classes of vertebrates and their natural relations. He has also revised the nomenclature of the marine fishes of our eastern coast from Greenland to Florida, and prepared a catalogue of them for the report of the United States Commissioner of Fish and Fisheries, and has, at the request of the same officer, investigated the genus *Micropterus*, comprising the black-bass, &c., and definitely established its species and nomenclature.

The Institution in 1870, fitted up a photographic apartment, under the charge of Mr. S. W. Smillie, in which photographs are taken of specimens of archæology and of natural history for illustrating the publications of the Institution, and for distribution to other museums. During the past year a large number of food-fishes and prehistoric remains have been photographed.

The specimens of the Institution are open to all investigators for study, and no work of importance on natural history has been published within the last twenty years in this country which has not been indebted to this establishment for the use of materials and other facilities in its production. The same privilege has been granted, under certain restrictions, to the officers of the Institution, and Professor Baird has availed himself of this by employing his leisure time for several years in the production of an extensive work on North American ornithology. In this enterprise Professor Baird has associated with himself Dr. Thos. M. Brewer, of Boston, and Mr. Robert Ridgeway, of Illinois. The work is published by Messrs. Little & Brown, of Boston, who have printed

three volumes, quarto size, embracing the land-birds. A second part, that on the water-birds, is in an advanced state of preparation, and the whole will be published within the year 1874. The work is fully illustrated by engravings finely executed in wood-cuts and in colored plates, and it is believed will meet a want long felt and expressed as to a manual of American ornithology.

CONCLUSION.

From the foregoing statements it will be evident that the Institution is still in a prosperous condition; that it is continually increasing in usefulness and reputation; that, although the current operations will be somewhat impeded during 1874 by the failure of the First National Bank, yet the effect of this loss will be but temporary; and that, with the appropriation from Congress for the care of the museum, the legitimate objects of the Institution can be prosecuted with more energy than heretofore.

Respectfully submitted.

JOSEPH HENRY,
Secretary.

WASHINGTON, *January*, 1874.

REPORT

OF

PROFESSOR JOSEPH HENRY,

SECRETARY OF THE SMITHSONIAN INSTITUTION,

FOR

THE YEAR 1874.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1875.

REPORT OF THE SECRETARY, PROFESSOR HENRY, FOR THE YEAR 1874.

To the Board of Regents of the Smithsonian Institution:

GENTLEMEN: I have again the honor to present to you another annual report of the operations and condition of the Institution which the Congress of the United States has placed under your charge. During the period embraced in this report, that of the year 1874, nothing has happened to interfere with the prosecution of the plans which have been adopted for "the increase and diffusion of knowledge among men." The Institution, having now existed upward of twenty-five years, has established a character and reputation in the eyes of the world, the tradition of which will tend to perpetuate the same policy, with only such improvements as experience may suggest, notwithstanding the changes to which the *personnel* of the administration may from time to time be subjected.

The following changes have taken place in the Board of Regents during the year: Chief-Justice Waite has been elected Chancellor of the Institution, in place of Chief-Justice Chase, deceased. Prof. Asa Gray has been elected Regent by Congress in place of Prof. L. Agassiz; Prof. J. D. Dana, in place of Professor Woolsey; Prof. H. Coppee, in place of William B. Astor; Hon. A. A. Sargent, in place of Hon. Mr. Trumbull; Hon. E. R. Hoar, in place of Hon. James A. Garfield; Hon. G. W. Hazelton, in place of Hon. L. P. Poland; and Hon. George Bancroft, in place of General Sherman. The change in the government of the District leaves vacant, for the present, the position of Regent occupied by the governor of the District.

The resignation of General Sherman, on account of his change of residence to Saint Louis, Mo., leaves a vacancy in the executive committee. It gives me pleasure to present to the board, as an expression of his feelings toward the Institution, the accompanying letter.* It is proper to mention in this connection that during the interval between the death of Chief-Justice Chase and the appointment of his successor, Mr. Justice Clifford, of the Supreme Court, presided as Chancellor of the board, and with the Secretary signed the requisition for drawing the semi-annual interest from the Treasury of the United States on the 1st of January, 1874.

Since the establishment of the Institution several different bequests have been made, intended to increase its usefulness; but from none of these has anything as yet been realized, except from that of JAMES HAMILTON, Esq., of Carlisle, Pa., who bequeathed one thousand dollars

* See proceedings of the Board of Regents.

to the Board of Regents of the Smithsonian Institution, the interest to be appropriated biennially for a contribution, paper, or lecture, on a scientific or useful subject. The money from this bequest has been received and placed in the Treasury of the United States, in accordance with the law of Congress authorizing the Secretary of the Treasury to receive any money which the Board of Regents may obtain from gifts, or savings of income, on the same terms as those of the original bequest. The first instalment of interest of the Hamilton bequest has just been received, and will be appropriated in accordance with the will of the testator at the end of next year, and so on continually at the end of every two years. A statement of the manner of expending this income will be given in the accounts of the operations of the Institution, with due credit to the donor. His name will therefore appear from time to time in the annual reports, and thus be kept in perpetual remembrance.

When the public shall become more familiar with the manner in which the income of the additional bequests to the Smithson fund is expended, with the permanence and security of the investment, and with the means thus afforded of advancing science, and of perpetuating the names of the testators, we doubt not that additions to the fund in this way will be made until it reaches the limit prescribed by law of one million dollars.

Since the establishment of the Institution great change has taken place in the public mind as to the appreciation of the importance of abstract science as an element in the advance of modern civilization. At the time the bequest of Smithson was made the distinction between original research and educational instruction in science and literature was scarcely recognized. As an evidence of this it may be stated that, in answer to a circular-letter addressed to a number of the most distinguished writers in this country, asking what should be done with a fund intended to increase and diffuse knowledge among men, the unanimous reply was, "Establish a national university;" the idea of a university being at that time an institution simply intended to drill youth in the ancient classics, in the elements of mathematics and physical and moral science. The idea of an institution intended for the higher object of increasing knowledge, or enlarging the bounds of human thought by original research, had not dawned at that time upon the mind of the general public, and the plan proposed for realizing this idea was violently opposed by some of the most intelligent and influential men of the country. Happily, since then a great change has been effected both in this country and in Europe, and to effect this change the persistent policy of the Institution has contributed in no inconsiderable degree. The plan adopted of applying the income as far as possible to the promotion of original research and the distribution of a knowledge of the results through its publications, has received the approval of the civilized world. The Congress of the United States

has fully signified its appreciation of the plan adopted, by relieving the Institution from the support of a library and the National Museum.

Congress having made an appropriation of $20,000 for the support of the National Museum, almost the entire income of the Smithson bequest has been left free to carry on what is now considered the legitimate operations of the Institution. It was thought, however, desirable to retain a part of the income in order to make up the loss of last year, occasioned by the failure of the First National Bank of Washington. The whole amount of deposit in this bank at the time mentioned was $8,224.87. On this the Institution has received 50 per cent., in two payments, leaving a balance of $4,112.43. Toward making up this loss, the expenditure during the year has been less than the receipts by $3,683.31. The funds of the Institution are therefore in a favorable condition, as may be seen by the exhibit hereafter to be presented.

FINANCES.

The following is a statement of the condition of the funds at the beginning of the year 1875:

The amount originally received as the bequest of James Smithson, of England, deposited in the Treasury of the United States in accordance with the act of Congress of August 10, 1846	$515,169 00
The residuary legacy of Smithson, received in 1865, deposited in the Treasury of the United States, in accordance with the act of Congress of February 8, 1867	26,210 63
Total bequest of Smithson	541,379 63
Amount deposited in the Treasury of the United States, as authorized by act of Congress of February 8, 1867, derived from savings of income and increase in value of investments	108,620 37
Amount received as the bequest of James Hamilton, of Carlisle, Pa., February 24, 1874	1,000 00
Total permanent Smithson fund in the Treasury of the United States, bearing interest at 6 per cent., payable semi-annually in gold	651,000 00
In addition to the above there remains of the extra fund from savings, &c., in Virginia bonds and certificates, viz: consolidated bonds, $58,700; deferred certificates, $29,375.07; fractional certificate, $50.13; total $88,125.20, now valued at	35,000 00
Cash balance in United States Treasury at the beginning of the year 1875 for current expenses	15,909 99
Amount due from First National Bank, Washington, $4,112.43, (present value unknown.)	
Total Smithson funds January, 1875	$701,909 99

On comparing this statement with that made last January, it appears that the total amount of the fund has been increased during the year $6,683.31, viz:

By the Hamilton bequest	$1,000 00
By the increased value of Virginia stock	2,000 00
By balance of unexpended annual income	3,683 31
	$6,683 31

The Board of Regents and the Secretary will in future be relieved of all anxiety as to the safety of the semi-annual interest by the arrangement which has been made with the United States Treasurer to receive it as a deposit, and to make payments from it on checks of the Secretary, in the same manner as has been done heretofore in the First National Bank.

The Institution is indebted to General Spinner for his prompt acquiescence in the proposition and for immediately carrying it out in all the details necessary to facilitate its operation.

Congress, at its last session, made an appropriation of $20,000 for the care and preservation of the specimens in the museum, and $10,000 for fitting up apartments in which the specimens are exhibited.

The uncollected coupons on the Virginia bonds held by the Institution were sold on the 9th of May, 1874, by Riggs & Co., with the following result:

$1,200 Virginia coupons at 77⅛	$925 50
$2,322 Virginia coupons at 77	1,787 94
	2,713 44
Less charges	17 61
	$2,695 83

This amount was deposited with the Treasurer of the United States to the credit of the account of the current expenses of the Institution for the year.

PUBLICATIONS.

Since the reports of the Institution are separately distributed to many persons who have not ready access to the whole series, it is necessary in each succeeding one to repeat certain facts which may serve to give an idea of the general organization of the establishment. The following statement is therefore repeated:

The publications of the Institution are of three classes, viz, the CONTRIBUTIONS to KNOWLEDGE, the MISCELLANEOUS COLLECTIONS, and the ANNUAL REPORTS. The first consist of memoirs containing positive additions to science resting on original research, and which are generally the result of investigations to which the Institution has, in some

way, rendered assistance. The Miscellaneous Collections are composed of works intended to facilitate the study of branches of natural history, meteorology, &c., and are designed especially to induce individuals to engage in these studies as specialties. The Annual Reports, besides an account of the operations, expenditures, and condition of the Institution, contain translations from works not generally accessible to American students, reports of lectures, extracts from correspondence, &c.

The following are the rules which have been adopted for the distribution of the several publications of the Institution:

1st. They are presented to learned societies of the first class which in return give complete series of their publications to the Institution.

2d. To libraries of the first class which give in exchange their catalogues and other publications, or an equivalent from their duplicate volumes.

3d. To colleges of the first class which furnish catalogues of their libraries and of their students, and all other publications relative to their organization and history.

4th. To States and Territories, provided they give in return copies of all documents published under their authority.

5th. To public libraries in this country, containing 15,000 volumes, especially if no other copies are given in the same place; and to smaller libraries where a large district would be otherwise unsupplied.

6th. To institutions devoted exclusively to the promotion of particular branches of knowledge are given such Smithsonian publications as relate to their respective objects.

7th. The Annual Reports are presented to the meteorological observers, to contributors of valuable material to the library or collections, and to persons engaged in special scientific research.

The distribution of the publications of the Institution is a matter which requires much care and judicious selection, the great object being to make known to the world the truths which may result from the expenditure of the Smithson fund. For this purpose the principal class of publications, namely, the Contributions, must be so distributed as to be accessible to the greatest number of readers, and this will evidently be to large central libraries.

The volumes of Contributions are presented on the express condition that, while they are carefully preserved, they shall be accessible at all times to students and others who may desire to consult them, and be returned to the Institution in case the establishments to which they are presented at any time cease to exist. These works, it must be recollected, are not of a popular character, but require profound study to fully understand them; they are, however, of importance to the professional teacher and the popular expounder of science. They contain materials from which general treatises on special subjects may be elaborated.

Full sets of the publications cannot be given to all who apply for them, since this is impossible with the limited income of the Institution; and, indeed, if care be not exercised in the distribution, so large a portion of the income would be annually expended on the production of copies for distribution of what has already been published, that nothing further could be done in the way of new publications. It must be recollected that every addition to the list of distribution not only involves the giving of publications that have already been made, but also those which are to be made hereafter.

At the commencement of the operations of the Institution the publications were not stereotyped, and consequently the earlier volumes have now become scarce, especially the *first*, of which there are now no copies for distribution, although it can occasionally be obtained at a second-hand book-store in one of the larger cities.

No copyright has ever been secured on any of the publications of the Institution. They are left free to be used by compilers of books, with the understanding, however, that full credit will be given to the name of Smithson for any extracts which may be made from them. This condition is especially insisted on, because the credit thus required is important as evidence to the world of the proper management of the Smithson fund. In many cases credit is given merely to the author without mentioning the name of the Institution; this is not just, since, as a general rule, the income of the establishment is applied not only to the publication of the article but also to assist in its production.

Publications in 1874.—During the past year the *nineteenth* volume of the quarto series of the Smithsonian Contributions to Knowledge has been published. It contains the following papers:

1. Problems of Rotary Motion presented by the Gyroscope, the Precession of the Equinoxes, and the Pendulum. By Brevet Maj. Gen. J. G. Barnard. 4to., pp. 74.

2. A Contribution to the History of the Fresh-Water Algæ of North America. By Horatio C. Wood, jr., M. D., professor of botany and clinical lecturer on diseases of the nervous system in the University of Pennsylvania. 4to., pp. 274, 21 colored plates.

3. An Investigation of the Orbit of Uranus, with General Tables on its Motion. By Simon Newcomb, professor of mathematics, United States Navy. 4to., pp. 296.

This volume, of which the several memoirs have been described in previous reports, will not only sustain, but increase the reputation of the Institution for its contributions to the science of the day. The memoirs which it contains have been received with manifest interest by the scientific world, and recognized as positive additions to knowledge resting on original investigation.

Besides the nineteenth volume of the Contributions to Knowledge, the *eleventh* and *twelfth* volumes of Miscellaneous Collections have been published during the year.

The *eleventh* volume of Miscellaneous Collections consists of 789 octavo pages, and contains the following articles:

1. Arrangement of the Families of Mammals, with Analytical Tables. Prepared for the Smithsonian Institution by Theodore Gill, M. D., Ph. D., pp. 104.

2. Arrangement of the Families of Fishes, or classes Pisces, Marsipobranchii, and Leptocardii. Prepared for the Smithsonian Institution by Theodore Gill, M. D., Ph. D., pp. 96.

3. Monographs of the Diptera of North America; Part III, Ortalidæ Family. Prepared for the Smithsonian Institution by H. Loew; four plates, pp. 376.

4. Directions for collecting and preserving Insects. Prepared for the use of the Smithsonian Institution by A. S. Packard, jr., M. D., pp. 60.

5. New Species of North American Coleoptera. Prepared for the Smithsonian Institution by John L. LeConte, M. D.; Part II, pp. 74.

6. Classification of the Coleoptera of North America. Prepared for the Smithsonian Institution by John L. LeConte, M. D., pp. 72.

The *twelfth* volume of Miscellaneous Collections consists of 767 octavo pages, and contains the following articles:

1. Review of American Birds, in the Museum of the Smithsonian Institution; Part I. By S. F. Baird, 1864–1872, pp. 484.

2. The Constants of Nature; Part I. Specific Gravities; Boiling and Melting Points; and Chemical Formulæ. Compiled by F. Wigglesworth Clarke, S. B. December, 1873, pp. 272.

3. Rules for the Telegraphic Announcements of Astronomical Discoveries. By Prof. Joseph Henry. April, 1873, pp. 4.

Since the publication of the 19th volume of Smithsonian Contributions, a memoir, of 32 quarto pages, has been printed and distributed, which will form part of the 20th volume. This is by Prof. S. Newcomb, of the National Observatory, Washington, on the "General Integrals of Planetary Motion"—an abstruse mathematical work, of which the nature is indicated in its title. It gives a series of suggestions and new investigations relative to the methods of determining the motions of celestial bodies as affected by interplanetary perturbations. It is in part an extension and generalization of two former papers by the same author, the first published in Liouville's Journal, vol. XVI, 1871, and the second in the Comptes-Rendus, vol. LXXV. It was submitted to Prof. H. A. Newton, of Yale College, and Mr. G. W. Hill, of Nyack, N. Y., for critical examination, and received their unqualified approval for publication in the Smithsonian Contributions to Knowledge.

Another paper, intended for the twentieth volume of Contributions, which has been printed and distributed during the past year, is by James G. Swan, on the Haidah Indians of Queen Charlotte Islands. It consists of 18 quarto pages, and is illustrated with five plain and two colored plates, to represent the carved posts or pillars raised in front of the houses of the chiefs, and various tattoo designs copied from the

bodies of the Indians. This paper was described in the last report. It may, however, be here mentioned that it is of special interest in connection with the large number of ethnological specimens received during the past year from the northwest coast.

Another work published during the year is the third of the Toner-lecture series. It is by Dr. J. M. DaCosta, of Philadelphia, on the strain and over-action of the heart, and forms 32 octavo pages, illustrated by two wood-cuts. These lectures, as has been stated in previous reports, have been instituted at Washington by Dr. Joseph M. Toner, and are confined to such memoirs or essays relative to medical science as contain some new truth fully established by experiment or observation. It is proper to remark that of this course of lectures only two have been published, the first and the third, the author having not yet furnished the manuscript of the second. To defray, in part at least, the cost of printing these lectures, it has been thought advisable to charge for them 25 cents a copy to individuals who have no special claim on the Institution by having contributed meteorological observations or additions to the collections.

Another work printed during the year is a list of the publications of the Institution to July, 1874, exhibiting 297 distinct articles, arranged first numerically, and secondly in regard to the subjects as given in the titles. It forms an octavo of 26 pages. An edition of 2,500 copies of this work was furnished to the "Publishers' Trade-List Annual" for 1874, (New York, October, 1874,) and through this medium the list of publications of the Institution will become known to all booksellers and librarians in the United States.

An edition of 250 copies of tables selected from the volume of Physical and Meteorological Tables, prepared and published some years since at the expense of the Institution, has been printed for the use of the Argentine Meteorological Observatory at Cordoba, under the direction of our distinguished countryman, Dr. B. A. Gould.

Publications in the press: 1. The Antiquities of Tennessee, by Dr. Joseph Jones, of which an account was given in the last report. Of this the wood-cuts have been prepared, and it is expected that the printing will be finished in the course of the present year.

2. A Memoir on the Harmonies of the Solar System, by Prof. Stephen Alexander, of the College of New Jersey.

In this communication the author divides his subject into three sections. Section I begins with the statement that Kepler's third law is ordinarily expressed by saying that the squares of the periodic times of the several planets of the solar system are to one another, respectively, as the cubes of their distances from the sun; but from this we do not learn that there are any laws determining the ratios of the distances themselves, and it is one of the main objects of the present discussion to show that such laws exist, and precisely what they are; generality and precision being characteristics of every law of nature.

The author discusses anew the expressed values of the distances in question, in view of the fact that Kepler's third law is itself slightly modified by the consideration due to the *masses* of the revolving bodies. After an exhibition and discussion of the appropriate formula, the author arranges the results in the form of a table; in which the results thus shown are respectively consistent with two values of the solar parallax, viz, Professor Newcomb's value, $\pi = 8''.848$, and that which others prefer, $\pi = 8''.78$.

Section II exhibits the laws of arrangement of the distances, both of planets and their satellites, from their respective centers of attraction, without the introduction in the same connection of any physical hypothesis on which those laws seem to be founded or of which they are the exponents.

From a comparison of the several distances of the planets, taking five-ninths of the distance of Neptune from the center of attraction and five-ninths of this product, &c., he finds among the several terms of the geometrical series thus formed, those which represent the relative distance of Saturn and Jupiter, also a position among the asteroids and those which represent the distance of Mars, and of Mercury in aphelion. There are, however, in the geometrical series just mentioned, terms which do not find their correspondences in the series of distances of the planets, but which the author very ingeniously supplies by attributing to certain of the planets the characteristic of half planets, the term pertaining to them being indicative of the distance between the two planets at which their masses would be united.

Section III exhibits an explanation of the phenomena founded on the nebular hypothesis of La Place, which seems to reconcile and account for the laws in question as well as a number of other phenomena.

Approximation to these laws have, from time to time, been exhibited by the author of this paper to the American Association for the Advancement of Science at several of its meetings, beginning with that at New Haven, in 1850; but it is only within the past few months that the entire form and consistency of the results have been quite fully made out. The principal part of the memoir was read before the National Academy of Sciences at its meeting in April, 1873, and some additional portions of the same at the meeting in April, 1874. In accordance with usage in such cases, the work was accepted for publication in the Smithsonian Contributions to Knowledge.

3. The Winds of the Globe, by the late Prof. J. H. Coffin, prepared at the expense of the Institution, relative to which further information will be given under the head of meteorology. Of this, 250 quarto pages have been stereotyped, and the whole work, which will form an entire volume of the Smithsonian Contributions to Knowledge, will be published during the year 1875.

4. The Temperature-Tables of the North American Continent, prepared

at the expense of the Institution, under the direction of Mr. C. A. Schott. Of this, 100 pages have been stereotyped.

Of the octavo publications there are in press:

1. The monograph on the American *Vespidæ* or wasps, by Professor de Saussure, of Geneva. Of this a full account was given in the last report. The rapidity of printing in this case is diminished by the necessity of sending the proof-sheets to Switzerland. The work has been stereotyped as far as the 236th page, and we trust will be completed in the course of a few months.

The Botanical Index, of which a notice was given in the Report for 1870, has been commenced, and 72 pages printed. This work is a complete index to all the species of plants of North America, with their synonyms, and all descriptions and important references to them. It is intended to facilitate the labors of working botanists, especially in the study of our western plants, the search for what has been written in regard to them requiring in many cases nearly as much time and labor as all the rest of their work.

As a further contribution to the "Constants of Nature" mentioned in the last report, Prof. F. W. Clarke has furnished an additional series of tables of specific heat and of expansion by heat for solids and liquids. We have also received from our collaborator, Prof. John L. LeConte, of the University of California, a series of constants relative to the weight of air, pressure of the atmosphere, length of seconds, pendulum-velocity generated by gravity in a mean solar second of time at various places, velocity of sound, &c. It is the intention of the Institution to continue this work, and to endeavor to enlist other co-laborers in its prosecution.

RESEARCHES.

Meteorology.—It was stated in the last report that the meteorological system of records by voluntary observers, which had been in operation under the direction of the Institution for about twenty-five years, had been transferred to the signal-office of the War Department, under General A. J. Myer. This transfer was made in accordance with the general policy of the Institution, namely, that of abandoning any field of enterprise as soon as the work could be done as well through other agencies, thus reserving the energy of the establishment for labors which required more aid in their accomplishment. We think this transfer has received the approbation of observers generally; who also, while they are now co-operating with the Signal-Service, still keep up their correspondence with the Institution on subjects of general scientific interest. The labors of the Institution in the line of meteorology are now confined to working up the material which it has collected during the last quarter of a century. The materials, however, are not limited to that period, but embrace everything that could be obtained on the subject from the records of previous observers.

The first work of this class which has been published is that of the the Rain-fall. It included all the material which had been collected down to 1866. It is now proposed to publish a new edition of this work, containing the additions since made, with improved maps, on a larger scale.

The next work of the same class is that on the Winds of the Globe, comprising the result of the discussion of not only the observations made under the direction of the Smithsonian Institution in the United States, but of those of every other part of the world of which the records were attainable. This work, to which the labors of Prof. J. H. Coffin, of Lafayette College, were for many years devoted, was nearly completed at the time of his death, has been continued by his son, Prof. Selden J. Coffin, and is now in the press. Very little, however, was done by the elder Coffin in the way of stating, in general propositions, the results contained in the large number of tables which he had elaborated. To supply this deficiency the Institution has fortunately been enabled to avail itself of the assistance of Dr. A. Woeikof, member of the Geographical Society of Russia, and late secretary of its meteorological commission, who, visiting this country for the study of its climatology, cheerfully undertook the required task.

The printing of this work is very expensive. It will occupy an entire volume of the Smithsonian Contributions, and comprise upward of 600 quarto pages of tabular matter, besides the letter-press. It will, however, we are confident, form a contribution to knowledge which will be a lasting monument to the industry of Professor Coffin and to the policy of the Smithsonian Institution.

The next work of the same class is that on the Temperature of the United States. It has been in progress at the expense of the Institution for a number of years. It includes the result of the discussion of all the observations which have been made in this country from the earliest times down to the present. It is illustrated by three maps of isothermal spaces—one exhibiting the annual, another the summer, and the third the winter distribution of temperature—and a number of diagrams incorporated in the text. It has been from the first under the direction of Prof. Charles A. Schott, of the Coast Survey, assisted by a number of computors, at the expense of the Smithson fund. The maps have been drawn and are in the hands of the engraver, and the whole work will be printed and distributed during the present year. It will form the first trustworthy approximation to an exhibition of the temperature of the various portions of the United States which has ever been published. The preparation of it has been more expensive than any other work ever undertaken by the Institution.

Another work in progress is that relative to the geographical distribution in the United States of thunder-storms, the frequency of their occurrence in different seasons, and effects produced by discharges of lightning, as compiled from all the records of the Institution during

twenty-five years. The preliminary labor was the collection and arrangement of a full list of stations at which thunder-storms have been recorded, the number of observations at each place, the time of beginning and ending of each storm, and the whole number of thunder-storms occurring in each year, and during the whole time at each place. From these data the relative frequency of thunder-storms in different parts of the country can be determined; also their relative frequency in different seasons and years, as well as the extent of the area over which they occur on the same day. The attending casualties, collected from all the observations made by several hundred observers during a period of twenty-five years, when brought together and classified, will strikingly illustrate the operations of one of the most energetic agents of nature.

For the preliminary arrangement of the materials preparatory to scientific deductions from them, the Institution has employed Mr. George H. Boehmer.

Another series of reductions relative to the meteorology of North America which will occupy the attention of the Institution is that of the discussion of the observations on the barometer in various parts of the United States. This will be commenced as soon as the other series of investigations are completed.

Comets.—The first research relative to these I have to mention is that relative to a comet of short period or one that returns after a few years. Of these, there are at present six known, namely, Encke's, which has a period of about $3\frac{1}{2}$ years; Winnecke's, of between 5 and 6 years; Biela's, of $6\frac{3}{4}$ years; Faye's, of $7\frac{1}{2}$ years; Tuttle's, of $13\frac{7}{10}$ years; and Halley's, of about 76 years.

All the other comets which have entered the solar system have never been known to return, their orbits having probably, in many cases, been changed by the perturbations of planets in whose vicinity they may have passed.

The motion of the periodical comets is an object of great interest to the astronomer, as well as to the general physicist, in its relation to the question of the existence of a retarding medium filling interplanetary spaces, and therefore it is considered an object of much importance, not only to observe their successive positions at their periodic returns, but also to calculate with great precision their orbits as affected by planetary perturbations. At a meeting of European astronomers in August, 1873, the work of discussing all the observations which have been made on four of these comets was parceled out among the continental astronomers, Halley's comet having previously received great attention from the English and other astronomers; and the fifth, that of Tuttle, discovered by an American astronomer, was left to be worked out in this country. This task has been undertaken at the expense of the Smithsonian Institution, under the direction of Prof. Ormond Stone, late of the National Observatory, and now professor of astronomy in the

University of Cincinnati. Professor Stone has chosen for this work a number of assistants, and will proceed with the reduction and discussion of the observations made on this comet at its several returns as rapidly as his other labors will permit.

The perturbations of the first order have been calculated, and the zero stars used in determining the place of the comet at the time of its last return in 1871 have been re-observed with the Washington meridian circle. An accurate determination of the orbit traversed by this comet in 1871, as based on the corrected position of these stars, has been in part completed.

In this connection it may be interesting to state that of the one hundred and forty* asteroids discovered during this century, forty-two were first observed by American astronomers. It is not enough, however, that these bodies should be noted as planets, and their positions marked in the heavens for a given epoch; it is also necessary that their orbits should be accurately determined, and an ephemeris of each of them calculated by which its place can be ascertained at any future time. This work, however, is one, as it were, of approximation, and must be continued through a series of revolutions of each planet. In regard to the asteroids discovered in Europe, the investigation of them is under the charge of European astronomers; while for the investigation of those discovered in America, Congress has made an appropriation for the last three years, to be expended under the direction of Professor Coffin, director of the American Nautical Almanac.

Efficiency of steam-heaters.—Another investigation, at the partial expense of the Smithsonian Institution, has been undertaken under the direction of General W. B. Franklin, late of the United States Army, at the Colt's Fire-Arms Manufacturing Company, Hartford, Conn., by Mr. C. B. Richards, of which the following is an account:

The experiments which are proposed will be in continuation of two series already made, to ascertain the relative efficiency of the different kinds of steam-heaters used for warming buildings, and to determine also the laws of their operation. The first series related to what are known as "direct radiators," and in these the heaters were exposed in a large room whose temperature could be changed and regulated as desired. In the second series the heaters were of the kind called "indirect radiators," and were inclosed in a flue through which currents of air were passed. The initial and final temperatures, the barometric pressure, and the moisture of the air were noted, and the quantity passed through the flue was measured by a Casella meter.

In both series the pressure of the steam was measured by an accurate mercury column, and its temperature was noted, while the heating effect of the heater was calculated from data obtained by collecting, cooling, and weighing the water of condensation obtained from the steam which was passed through the heater.

* Since the above was written two additional asteroids have been discovered.

Very satisfactory and consistent results were arrived at from the first series. But in the second series, the cost of the apparatus, the many different circumstances which it was necessary to take into account, the consequent greater care and time required in the investigation, and a lack of money with which to pursue the inquiry to the proper point, prevented the establishment of trustworthy data.

The importance of deciding the questions which it is the specific object of these experiments to answer need not be urged. There is, however, one interesting circumstance which, among others, was observed, and which may be of importance outside the principal question. This relates to the determination of the condition of the steam as regards its dryness when it entered the heating apparatus; and, as a small quantity of steam was occasionally allowed to escape after it had passed through the heater, (in order to carry off air,) it was also desirable to ascertain whether any very considerable amount of water, in the condition of mist, was carried away by this escaping steam.

Hirn's method was employed in these determinations. Although the apparatus for this purpose was crude, and for precise experiments would require to be much improved, the experiments seemed to indicate clearly that the steam was nearly if not quite as dry, after passing over the condensing surface of the heater, as before; that is to say, its "mistiness" was not increased by its passage over a large extent of condensing surface. These results, if fully verified by a longer series of experiments with better apparatus, would indicate that there is a fallacy in the generally-entertained idea that "wet steam" is supplied to an engine if the originally dry steam is led through a long pipe.

The records of the experiments are voluminous, and it is intended to tabulate them, and to represent the results by curves when the whole are completed.

Elevations.—It has been mentioned in previous reports that the Institution has been at considerable expense in collecting the profiles of canal, railroad, and other surveys, in order to the construction of a topographical map of the United States. The charge of this work was given to Mr. Nicholson, topographer to the Post-Office Department, but, owing to the absorbing nature of his official duties, he has been unable up to this time to complete it. In the mean while Mr. Gardner, of the Hayden expedition, has rendered an important service to this investigation by settling, through critical comparison of various surveys, the actual height of several important places in the interior, which will hereafter serve as points of departure for other surveys.

Natural History and Ethnology.—Various researches have been made in natural history and ethnology, the actual expense of which has been defrayed by the Institution, without salary, however, to the person in charge of the work; an account of which will be given in a subsequent part of the report.

INTERNATIONAL EXCHANGES.

The Smithsonian system of international exchange still continues to render an important service to the advance of civilization, and emphatically to carry out the second clause of the will of Smithson for the increase and diffusion of knowledge among men—that is, mankind. It is the medium of exchange of literary and scientific materials between the United States and all foreign countries.

The effect of this system on the diffusion of knowledge can scarcely be too highly estimated. Thousands of works, containing the details of the latest inventions and discoveries, are through its means annually brought to this country, while a knowledge through the same medium is disseminated abroad of everything that is doing in the United States to promote a higher civilization.

As an evidence of the high estimation in which this part of the operations of the Institution is regarded, we may again mention that the Smithsonian packages are passed through all the custom-houses of the world free of duty and without examination, and, moreover, that they are transmitted free of cost by the principal transportation companies, namely:

Pacific Mail Steamship Company.
Panama Railroad Company.
Pacific Steam Navigation Company.
New York and Mexico Steamship Company.
New York and Brazil Steamship Company.
North German Lloyd Steamship Company.
Hamburg American Packet Company.
French Transatlantic Company.
North Baltic Lloyd Steamship Company.
Inman Steamship Company.
Cunard Steamship Company.
Anchor Steamship Company.

The special thanks of the Institution are again due to the above-mentioned companies for their enlightened liberality.

The following are the foreign centers of reception and distribution of the Smithsonian exchanges:

London—Agent, William Wesley, 28 Essex street, Strand.
Paris—G. Bossange, 16 rue du 4 Septembre.
Leipsic—Dr. Felix Flügel, 12 Sidonien Strasse.
St. Petersburg—L. Watkins & Co., 10 Admiralty Place.
Amsterdam—F. Müller.
Milan—U. Hoepli, 591 Galeria Cristoforia.
Harlem—Prof. Baumhauer.
Christiana—Royal University of Norway.
Stockholm—Royal Swedish Academy of Sciences.
Copenhagen—Royal Danish Society.

The following table exhibits the number of foreign establishments with which the Institution is at present in correspondence, or, in other words, to which it sends publications and from which it receives others in return:

Number of Foreign Corresponding Institutions.

Sweden	20	Belgium	110
Norway	24	France	274
Iceland	2	Italy	169
Denmark	27	Portugal	20
Russia	160	Spain	12
Holland	65	Great Britain and Ireland	357
Germany	622	South America	40
Greece	7	West Indies	7
Turkey	11	Mexico	10
Africa	23	Central America	1
Asia	42	British America	27
Australia	27	General	5
New Zealand	13		
Polynesia	2	Total	2,146
Switzerland	69		

The table in itself is interesting as indicating the relative attention given to literature and science at the present day in the different countries of the world.

During the past year 4,326 packages, each containing several articles, have been received from abroad for distribution to institutions and individuals in this country.

One hundred and forty-one boxes, averaging 7 cubic feet each, with a total weight of 29,600 pounds, were sent abroad by the Institution during the year, viz: To Germany, 40; England, 30; Sweden, 5; Norway, 3; Denmark and Iceland, 4; France, 11; Russia, 7; Holland, 5; Belgium, 5; Australia, 11; Italy, 3; Cuba, 2; Brazil, 3; Liberia, 1; Egypt, 1; Canada, 10.

The total number of separate parcels contained in these boxes was about 10,000.

To facilitate the business of the exchanges, the following rules have been adopted:

1. Every package, without exception, must be enveloped in strong paper, and secured so as to bear separate transportation by express or otherwise.

2. The address of the institution or individual, for whom the package is intended, must be written legibly on the cover, and the name of the sender on one corner of the same.

3. No single package must exceed the half of a cubic foot in bulk.

4. A detailed list of addresses of all the parcels sent, with their contents, must accompany them.

5. No letter or other communication can be allowed in the parcel, excepting such as relates exclusively to the contents of the package.

6. All packages must be delivered in Washington free of freight and other expenses.

7. Every parcel should contain a blank acknowledgment, to be signed and returned, either through the agent of the Institution, or, what is still better, through the mail, to the sender. Should exchanges be desired for what is sent, the fact should be explicitly stated on the list of the contents of the package. Much disappointment is frequently expressed at the absence of any return in kind for transmissions; but un-

less these are specifically asked for they will fail in many instances to be made. It will facilitate the labors of the Institution very greatly if the number corresponding to the several addresses in the Smithsonian printed catalogue* be marked on the face of each parcel; and for this purpose a copy of the catalogue will be forwarded to all who apply for it.

Specimens of natural history will not be received for transmission unless with a previous understanding as to their character and bulk.

8. Unless all these conditions are complied with the parcels will not be forwarded from the Institution; and, on the failure to comply with the first and second conditions, will be returned to the sender for correction.

The operations of the system of exchange have increased from year to year, and notwithstanding the liberal assistance received from transportation companies, it now absorbs nearly a seventh part of the entire income of the establishment. In order to improve its efficiency and the frequency of transmission of packages, a larger proportion of the income will be required. In view of these facts, the Secretary at the last session of the Board of Regents was authorized to receive aid from societies and individuals in defraying the heavy expense of this part of the operations of the Institution.

Miss Jane Turner, sister of the late Prof. W. W. Turner, the well-known philologist, continues to have charge of receiving and cataloguing the exchanges intended for the library of the Institution, and of distributing those for other parties.

The receiving, packing, and shipping of the packages from different parts of the United States intended for foreign countries, is under the charge of Mr. H. Diebitsch.

LIBRARY.

In 1866, the library of the Institution was incorporated with that of Congress. This arrangement is still continued, and is beneficial to both establishments. The Smithson fund is relieved from the maintenance of a separate library, while at the same time the Institution has the use not only of its own books but of those of the Library of Congress. On the other hand, the Library of Congress is enriched by an entire department, that of books relating to modern science.

The following is a statement of the books, maps, and charts received by exchange in 1874:

Volumes:		
Octavo, or less	657	
Quarto, or larger	206	
		863

*Miscellaneous Collections, No. 243.

Parts of volumes:		
Octavo, or less	1,607	
Quarto, or larger	1,359	
		2,966
Pamphlets:		
Octavo, or less	1,962	
Quarto, or larger	593	
		1,555
Maps and charts		162
Total receipts		5,546

Among the principal donations received in 1874, are the following:

From the Company of Public Works of the Mediterranean: "Bassins de Radoub de Marseille. Notice sur l'exécution des travaux," with an atlas of 40 plates, (2 copies.)

From the Argentine Confederation: "Description géographique et statistique de la Confédération Argentine, par V. de Moussy," vols. i–iii, with folio atlas.

From the National Hungarian Museum, Buda-Pesth: "Monuments épigraphiques du Musée National Hongrois, dessinés par Ernest Desjardins," 1 vol., folio, Buda-Pesth, 1873.

From the Imperial Archæological Commission, St. Petersburg: "Compte-rendu de la Commission Impériale Archéologique," for 1870 and 1871, with folio atlas.

From the Icelandic Literary Society, "Reykjavik Skirnir," 1874: "Skyrsla um Forngripasafu Islands i Reykjavik," vols. i, ii, 1863–1870. Copenhagen, 1868, 1874. "Fyettir fra Islandi," 1873. Reykjavik, 1874, 8vo.

From the Universities of Berlin, Bonn, Erlangen, Freiberg, Göttingen, Greifswald, Halle, Jena, Leipzig, Marburg, Rostock, Würzburg, Basel, Bern, and Zurich: Inaugural Dissertations for 1873.

From the Hydrographic Department of the Ministry of Marine, St. Petersburg; 23 charts, 10 volumes, and 6 pamphlets.

From the Veterinary School, Dorpat, 48 pamphlets.

From the British Museum, London, "Catalogue of Greek Coins, Italy," 1873, 8vo.; "Catalogue of Roman Coins in the British Museum, Roman Medallions," 1874, 4to.; "Catalogue of Prints and Drawings," Division I. "Political and Political Satires," vol. ii., 1869–1873, 8vo.; "Fac-similes of Ancient Characters," 1873, folio; "Catalogue of Birds," vol. i, 1874, 8vo.; "Hand-List of Seals, Morses, Sea-Lions, etc.," 1874, 8vo.; "Hemiptera, Heteroptera," vol. viii, 1873, 8vo.; and various guide-books.

From the Board of Admiralty, London, 28 charts published by the Hydrographic Office, from January, 1873, to January, 1874; "The China Sea Directory," vol. iv; "The Mediterranean Pilot," vol. i; "Red Sea Pilot," 1873; "Tide-Tables," 1874; "Nautical Almanac for 1878;" and 10 lists of lights.

From the Overijssel Society for the Promotion of Provincial Welfare, Zwolle, 8 volumes, 8 parts, and 5 pamphlets.

From the Royal Statistical Bureau, Copenhagen, "Statistisk Tabelvoerk," vols. xx–xxvi, (2 copies;) "Sammendrug," etc., 10 parts.

From Messrs. Robert and Alexander Stuart, New York, "Anti-Nicene Christian Library; Translations of the Writings of the Fathers down to A. D. 325," 24 volumes.

From the Ministry of Agriculture, Industry, and Commerce, Rome, 10 volumes and three pamphlets published by the department.

From the Central Bureau of Statistics, Stockholm, "Bidrug till sveriges officiela Statistik," 22 parts.

From the Medico-Chirurgical Society of Modena, 27 medical pamphlets.

From the Norwegian Government, "Norges Officiela Statistik," 1873, 13 parts, 4to; and 4 volumes on Norwegian Statistics.

From the State library of Virginia, 9 volumes of State documents.

In addition to the books which have been received, we are indebted to Major-General J. H. Lefroy, governor of Bermuda, a special friend of the Institution, for a series of manuscripts procured by him during a late visit to England, and presented through him by his relative, Mrs. Dundas, of Canon Hall, Larbert, N. B.

The following is a report on these manuscripts by Mr. Spofford, Librarian of Congress:

"These original records form a collection of the highest interest and value as materials of personal and political history at a period which must ever remain the most important era in the annals of the United States. One of the volumes contains twelve reports submitted to the lords of Her Majesty's treasury, by John Wilmot, Colonel Dundas, and the other commissioners, upon the losses and services of the claimants who were loyal to the British crown during the revolutionary war, and who were afterward indemnified by act of Parliament. Six reports in addition, signed by Colonel Dundas and Mr. J. Pemberton, commissioners, and extending from A. D. 1784 to 1789, are also embraced. Thirty-four of the manuscript volumes contain a large amount and variety of facts and testimony regarding the landed possessions and personal property of hundreds of British subjects in the New England States, as well as in New York, New Jersey, Pennsylvania, etc. As most of these papers have never been published, they are the more valuable and original and unique repositories of information regarding the persons to whom they relate, the descendants of many of whom still survive among the people of the United States."

The edition of the volume of the catalogue of Transactions of Learned Societies, originally prepared by the Institution, containing a list of the works of this branch of bibliography, deposited in the Library of Congress, having been exhausted, Mr. Spofford is about to publish a new edition containing all the late additions which have been made to the

collection. It will also contain, in an appendix, a catalogue of scientific periodicals, with the date of publication of each volume, compiled under the auspices of the Smithsonian Institution, by Dr. H. Carrington Bolton, of the Columbia College School of Mines, New York.

TELEGRAPHIC ANNOUNCEMENT OF ASTRONOMICAL DISCOVERIES.

The important arrangement which was concluded between the Smithsonian Institution and the Atlantic cable companies in 1873, by which free telegraphic transmission of astronomical discoveries was granted between Europe and America, has been continued during the past year. The number of announcements, however, has not been as great as during the previous year.

The following list comprises the *asteroids* discovered in 1874:

No.	Name.	Discoverer.	Date.
135	Hertha	C. H. F. Peters, at Clinton, N. Y.	February 18, 1874.
136	Austria	M. Palisa, at Pola	March 18, 1874.
137	Melibœa	M. Palisa, at Pola	April 21, 1874.
138	Tolosa	M. Perrotin, at Toulouse	May 19, 1874.
139		J. C. Watson	Oct. 10, 1874.
140	Siwa	M. Palisa, at Pola	Oct. 13, 1874.

Eight *comets* have been detected during the past year.

No.	Discoverer.	Date.
1	Winnecke, at Strasburg	February 20, 1874.
2	Winnecke, at Strasburg	April 11, 1874.
3	Coggia, at Marseilles	April 17, 1874.
4	Borelly, at Marseilles	July 25, 1874.
5	Coggia, at Marseilles	August 19, 1874.
6	Borelly, at Marseilles	December 6, 1874.

These comets, except No. 3, were strictly telescopic.

The number of amateur astronomers in the United States who are provided with telescopes of sufficient power to detect minute heavenly bodies is every year increasing, and the discovery of new comets and asteroids offers an interesting field for their cultivation. The plan adopted by Professor Watson, of Ann Arbor, furnishes a definite means for the discovery of asteroids. It consists in studying with great minuteness a narrow band in the heavens, of two or three degrees in width, extending at right angles to the ecliptic, twenty degrees or more on each side. At some time in the revolution of an asteroid around the sun it must pass through this band, and, if each fixed star in this circumscribed space be accurately mapped and its relative place be made familiar to the observer, any new object which presents itself within this area may be readily detected.

NATIONAL MUSEUM.

For many years after the Institution took charge of the National Museum only $4,000 was allowed by Congress for the annual expense on account of this duty. In 1871 the appropriation for this purpose was increased to $10,000, and in 1872 to $15,000, and for the last year to $20,000; the last-mentioned sum being sufficient for the present to defray the annual expense without encroachment on the income of the Smithson fund, nothing being charged on account of rent of the building. In addition to this, $10,000 was appropriated for the completion of the cases in the large room of the second story, devoted to ethnology. This money was expended in procuring cases in the form of tables with glass tops and sides for the exhibition of smaller articles.

The following report from Professor BAIRD gives an account of the additions to the museum and the various operations connected with it during the past year:

Increase of the National Museum.

As in previous years, nearly every region in North America, and a considerable number of localities in Central and South America, as well as in other parts of the world, have been represented in the collections of 1874; the following summary showing, in a general way, the more important of the acquisitions from a *geographical* point of view:

From *Greenland* has been received a collection of articles of Esquimaux dress and other interesting curiosities, including the skeleton of a polar bear.

The *arctic main land* of North America is represented by perfect skins, with the skeletons complete, of adult male and female musk-oxen, forming an acquisition that any museum would consider of great importance.

Alaska has been richly represented during the year by a good series of ethnological material of the Thlinket tribes of Sitka and the adjoining region, including a number of the stone implements which are now entirely gone out of use and very rare; also, from the Maglemut Esquimaux of the island of Nunivak, Behring Sea, a remarkably full series of their utensils, weapons, and carvings. This addition, with what had previously been obtained, gives to the National Museum a finer collection of Western Esquimaux material than exists in all other ethnological museums combined.

A series of dredgings has also been received, made in the Northern Ocean, in the vicinity of Kotzebue Sound, and in other portions of Behring Sea; a large collection of birds with their eggs, among them specimens of the *Sterna aleutica* and other rare species, and series of skins and skeletons of the fur-seals, &c.

Queen Charlotte's Island and Washington Territory.—From these we

have received ethnological objects, consisting principally of elaborate carvings made by the Haidah Indians, a race excelling any other aboriginal people on the continent in the skill and variety of the designs which they engrave on bone and wood.

Oregon is represented very satisfactorily by a series of prehistoric remains obtained from shell-heaps. These are of extreme beauty of finish, and constitute a highly-prized addition to the ethnological collections of the Institution.

California, as usual, occupies a prominent place in the record of additions to the museum, more particularly in the line of archæology, including prehistoric remains from the shell-heaps, some of them opening a new page in American archæology in the variety and complexity of the objects, and in their great beauty of finish. The applications and uses of many of them constitute puzzling problems in ethnology.

From the Pacific coast we have also received specimens of the cetaceans, and an interesting and valuable collection of eggs.

Arizona, *Utah*, and *Colorado* are richly illustrated by the specimens collected by the various Government exploring expeditions, in all the departments of natural history and ethnology. These regions may almost be considered as more fully represented in the National Museum than any other portion of the continent, with the exception of Alaska. A collection of eggs from Arizona challenges competition for beauty of preparation and variety of species; also ethnological objects of much interest.

From *Montana*, specimens of the grayling fishes have been received, among which a new species has been described by Mr. Milner, *Thymallus montaniensis;* a collection of birds, and a fine specimen of mule-deer.

New Mexico is represented principally by specimens of Navajo workmanship, fossil remains, and minerals in much variety.

Dakota.—As in previous years, large collections, especially in natural history, have been received from this Territory, particularly from the officers of the Northern Boundary Survey.

Central portion of the United States.—The collections from this region have consisted principally of crania, stone implements, pottery, worked bones, &c., from Tennessee, Indiana, Illinois, Ohio, Iowa; minerals and rocks from Tennessee; skins of salmonidæ of Lake Superior; specimens of the Michigan grayling, and of the giant snapping-turtle from Louisiana.

Eastern portion of the United States.—We have received specimens of bone implements and other ethnologica from New York, Pennsylvania, and Virginia; fresh-water and land shells and Otsego bass from New York; young California salmon from the Susquehanna River; fossil ferns and a specimen of the Arkansas fly-catcher from Maryland; and fishes from Virginia.

Florida is well represented by human crania, shell-heap remains, and other ethnological objects, living alligators, fishes, shells, and reptiles;

among the latter a specimen of *Elaps distans*, a serpent previously unknown excepting in Arizona.

From *Newfoundland* we have had a series of stuffed skins of several species of seals of different ages.

From *Mexico* a collection of reptiles and fishes.

From *Cuba* a continuation of the complete series of species of fish, which the Institution has received from its correspondents on that island.

Central America, as usual, has furnished very important collections, among them birds and reptiles from the isthmus of Tehuantepec; specimens of the musical instruments of the aborigines of Guatemala; poisonous serpents of Nicaragua, and, above all, a series of mammals, birds, reptiles, fishes, shells, insects, and ethnology from Costa Rica.

South America.—The receipts from this part of the western hemisphere have not been very large, consisting principally of some casts of stone implements from ancient mines in Chili, and ethnological objects, birds, mammals, and serpents from Brazil, as well as a specimen of sea-lion from Patagonia.

Europe.—The additions of the year consist of marine shells, cretaceous fossils from Sweden, and skeleton of the white porpoise from Norway; also models of the common form of weir used in Denmark for the capture of fishes; minerals from Saxony; highly valuable specimens of crania and pottery belonging to the Anglo-Saxon period of British history; prehistoric objects from the celebrated locality of Solutré, among them numerous bones of the horse, the remains of which, to the number of many thousands of individuals, have been accumulated in a single depository.

Other parts of the world.—Among the most noteworthy of the collections received are those of fishes, crustaceans, seeds, bulbs, shells, &c., from the island of *Mauritius;* models of dwellings, articles of dress, specimens of fishes, crustaceans, corals, &c., &c., from the *Samoan Islands;* and fishes from *Kamtschatka.*

Not the least interesting and important of the collections of the year are "squeezes" from Egyptian antiquities, and a perfect copy of the Tanis or Canopus stone, from the museum at Boulak, of which a much inferior copy was already in possession of the Institution.

Miscellaneous.—The Navy of the United States has very largely contributed specimens collected during the voyages of the Portsmouth among the Pacific Islands; of the Narragansett in the Gulf of California and vicinity, embracing shells, fishes, birds, and ethnology; and of the Tuscarora in the Pacific Ocean, between the United States and the Sandwich Islands and Japan, consisting of the soundings taken while selecting a suitable line for a trans-Pacific telegraphic cable.

Systematic summary.—Having described the principal additions to the National Museum in 1874 in geographical order, it may not be amiss

to refer briefly to them again in their systematic sequence, as likely to give a better idea of the actual increase in the scientific value of the collections.

Of the various additions received during the year, those which are most varied and comprehensive in their nature, and of most importance, have been derived from the labors of Mr. W. H. Dall and Mr. H. W. Elliott, in Alaska; of Mr. Archibald Campbell, Major Twining, and Dr. E. Coues, of the Northern Boundary Survey, in Dakota; of Major Powell, Lieutenant Wheeler, and Dr. Hayden, in Utah, Arizona, and Colorado; of the United States steamers Portsmouth and Narragansett, in the Pacific Ocean; of Capt. Nicholas Pike, in the Mauritius; of the United States Fish-Commission on the eastern coast of the United States; and of Professor Gabb, in Costa Rica.

Ethnology.—The Smithsonian Institution has been, for several years past, especially interested in extending the ethnological collections of the National Museum, desirous that this should embrace as full an illustration of American archæology as possible. The results of its efforts in this direction have been very satisfactory, few days elapsing without the receipt of one or more packages of specimens. These collections are so numerous, indeed, as to render it impossible to mention them all here; and we can only specify a few, referring to the list of donations for a statement in full.

By far the most important of these collections were those received from Alaska and the west coast of America and from Costa Rica, already referred to in general terms. The specimens procured by Mr. Dall furnish a full representation of the prehistoric antiquities of the islands and the main land of Alaska, as also of many of the objects at present in use among the Esquimaux, the Aleutians, &c. Mr. Elliott's collections relate more especially to Saint Lawrence Island, Behring Sea, a region previously unrepresented in any collection.

The collections made in Oregon by Mr. A. W. Chase and Mr. Paul Schumacher relate to the shell-heap deposits, and are quite unique in their character. Still more so are the gatherings made by Mr. Dall and Mr. Schumacher from the islands and main land of Southern California. The carvings by the Haidah Indians, collected by Mr. J. G. Swan, are of great interest and beauty.

The collections of Doctor Gabb, of both modern and prehistoric ethnology in Costa Rica, are of very great extent and of extreme value, and are supplemented by a collection of aboriginal musical instruments from Guatemala, furnished by Mr. Henry Hague.

Large numbers of stone implements, pipes, pottery, &c., have been received from the expeditions of Major Powell, Doctor Hayden, and Lieutenant Wheeler, from Governor Arny, of New Mexico, and from many localities in the interior and in the east, all together forming an aggregate of very great extent. Conspicuous among these are speci-

mens of bone implements obtained by Mr. Frank H. Cutting in Central New York. Mr. J. H. Jenkins, of Northumberland, Pa., has increased the extent of his deposits by numerous additional objects. General M. C. Meigs, Quartermaster-General United States Army, has furnished ethnological specimens from Arizona of much interest.

Among the articles obtained from the Mississippi Valley is a remarkable stone pestle, or muller, from the Rev. Joshua Hailes, senior. This is stirrup-shaped, and quite unique in North America; although similarly-shaped objects, with the same function, are known in Central America and the Sandwich Islands.

A noteworthy article in this department consists of a specimen of ancient cloth from a rock-dwelling near Montezuma Wells, in Arizona, presented by Lieut. E. B. Hubbard. Dr. J. F. Snyder, of Illinois, has furnished a large number of disk-shaped, chipped stones, of great beauty.

Of Old World collections we have mentioned a copy of the Tanis or Canopus stone, presented by the Khedive of Egypt, and, through General Charles P. Stone, numerous "squeezes" of Egyptian antiquities, contributed by the latter gentleman; a series of Saxon crania, and other antiquities, from Professor Rolleston, of Oxford; specimens from the prehistoric burial-places near Solutré, presented by Professor Lartet, and valuable collections from the Samoan Islands, by A. B. Steinberger, esq.

Under the head of *Mammals*, an important acquisition is that of a perfect pair of skins and skeletons of musk-oxen, from Mr. Hardisty, of the Hudson's Bay service, in arctic North America.

Mr. P. T. Barnum, in pursuance of his liberal offer to place at the disposal of the Institution, for the use of the National Museum, all such animals from his menagerie as might die on his hands, has furnished specimens of the nylghau, the manatee, the dromedary, the sun-bear, and other species. A specimen of the sea-lion of Patagonia has been received from Doctor Burmeister, of Buenos Ayres. Henry W. Elliott has procured for us a series of skins and skeletons of the fur-seals. Doctor Gabb has furnished complete collections of nearly all the known mammals of Costa Rica, in great number. Professor Pagenstecker presented skins of various European mammals. A series of the seals of Newfoundland was received from Rev. M. Harvey; and Captain Scammon has contributed additions to the series of cetaceans of the Pacific Coast, especially that of California, it being his intention to render the collection of the National Museum as complete as he can make it. The objects received illustrate his important work on the marine mammals of the western coast of the United States.

The Vienna Museum has supplied skins and skeletons of several species of Old World mammalia. From Doctor Bessels has been received a skeleton of the polar bear, and from Doctor Yates casts of the teeth of the fossil elephant of California. Señor Albuquerque, of Brazil, has

furnished living specimens of the coatimundi; and Doctor Nichols, of the Washington Insane Asylum, the body of a very large grizzly bear.

Specimens of the black-tailed deer and American panther were obtained for the Institution by Mr. James Stevenson, of Doctor Hayden's survey. One of the most important contributions of the year, as far as the mammalia of North America are concerned, consisted of several specimens of the black-footed ferret, (*Putorius nigripes*,) a weasel described by Mr. Audubon in 1843 from a single specimen, which has not been since caught until the present year, when specimens were transmitted to the Institution by Mr. La Munyon, Dr. Law, and Mr. L. H. Kerrick.

Especially noteworthy among the *birds* received during the year is a specimen of the dodo pigeon (*Didunculus strigirostris*) from the Samoan Islands, presented by Mr. A. B. Steinberger. This species is best known from having been collected by the Wilkes Exploring Expedition, and described nearly simultaneously by Sir William Jardine and Mr. Titian R. Peale. It is confined to these islands, where it is nearly extinct. This specimen is especially valuable from being presented entire in alcohol, thus furnishing an opportunity of a thorough anatomical investigation of its characteristics. A living specimen just received at the Zoological Garden in London has attracted great attention.

Mr. Lucien M. Turner, now stationed at Saint Michael's, in Norton Sound, as an observer in the Signal-Service, has sent a number of birds, with their eggs, of much interest, among them specimens of the *Sterna aleutica* and other rare species.

A cast of part of the skull of a remarkable fossil bird from the Sheppey clay, of England, (the *Odontopteryx toliapicus*,) has been received from Mr. Bryce M. Wright. Mr. Barnum has supplied, from the specimens that died in his menagerie, the cassowary, the emu, and the ostrich. From Dr. Gabb has been received a very large series of the birds of Costa Rica. Mr. J. E. Harting, of London, has supplied some rare specimens of the grallæ. Collections of the birds of Colorado have been furnished by Mr. C. G. Aiken and Mrs. Maxwell; of the Isthmus of Tehuantepec, by Professor Sumichrast; of the Prybilov Islands, from Mr. George R. Adams. Collections of the birds of Brazil were furnished by Señor Albuquerque, and of Buenos Ayres by Dr. Burmeister; a series of rare species from Ecuador was also received from the Wesleyan University, at Middletown, Conn.

A noteworthy fact is the receipt of a specimen of the Arkansas flycatcher, killed in Maryland, and presented by Mr. Jouy, this species being usually confined to the western plains.

The most important of the collections of *eggs* received are those furnished by Captain Charles Bendire, United States Cavalry, from Southern Arizona; those from Dr. William A. Cooper, of Santa Cruz, California; from Florida by Professor Jenks, and from Alaska by Mr. Dall and Mr. Elliott.

The collections of *reptiles* received during the year have not been very extensive, the most important being the series furnished by Mr. Gabb from Costa Rica, and those brought in by the expedition of Lieutenant Wheeler. Captain Bendire has furnished a specimen of the rare *Heloderma horridum*, a curious lizard from Arizona; and several living alligators from Florida have been supplied by Messrs. Chandler and Boyd. Mr. John Potts, a correspondent of many years' standing, has again evinced his interest in the Institution by sending a collection of reptiles and fishes from Mexico. A living sea-turtle from Florida was presented by the honorable Secretary of the Navy, and a giant snapping-turtle of the Mississippi, by Mr. Boyd. Dr. Reuss has furnished collections of reptiles from Illinois, Professor Sumichrast others from the Isthmus of Tehuantepec, Mr. John Queseda the poisonous serpents of Nicaragua, and a series gathered during the operations of the Northern Boundary Survey was brought in by Dr. Coues. Mr. Meek obtained from Florida a specimen of *Elaps distans*, a serpent to which reference has already been made, as previously known only in Arizona.

The collections of *fishes* embrace some of the most noteworthy additions of the year, these having been made with special reference to the operations of Professor Baird as United States Commissioner of Fish and Fisheries. The most important of these were gathered by himself on the coast of New England, especially in the vicinity of Noank, Conn., where he had his headquarters during the past summer. These embrace full series of all the kinds known to occur in those waters, supplemented by rare specimens sent by his agents and correspondents at Wood's Hole, Portland, and elsewhere. Large numbers, too, of the fishes of the great lakes and of the Mississippi, &c., have been supplied, among them specimens of the grayling of Michigan and of Montana, including several new species; and series of white-fish from Maine, New Hampshire, and elsewhere, have also been received. Mr. E. G. Blackford, the well-known dealer in fish at Fulton Market, New York, has been especially serviceable in this connection by keeping a sharp watch over the rare and curious fish coming into New York, and sending them suitably packed in ice to Washington. By means of the various fresh fishes thus obtained, the series of casts of the food-fishes of the United States, commenced a few years ago, has been greatly extended during the past season, this now numbering over three hundred specimens, painted carefully from nature, and representing fishes and cetaceans, some of them of nearly a thousand pounds weight. This collection of casts is unique in this country, and is only represented on a smaller scale by that of Mr. Frank Buckland, in London, and that of the natural history museum of Trinity College, Dublin.

Other specimens of fishes are those from the coast of Virginia, supplied by Prof. H. E. Webster; skeletons of the fishes of South Carolina, from Mr. G. E. Manigault; specimens from the Sacramento Bay, sent

by Mr. L. Stone; from the vicinity of New Bedford, by Mr. John H. Thomson; from Florida, by Mr. G. B. Goode; from the Susquehanna River, by Mr. T. H. Bean and Mr. Jas. Creveling; from Montana, by Dr. Hart; from Lake Superior, by J. T. Coleman; from Michigan, by D. H. Fitzhugh, jr., and Fred. Mather; from Cooperstown, N. Y., &c., by Captain Phinney,

Of fishes from regions outside of the United States, specimens have been furnished from the fresh waters of Central Europe, by Dr. Middleton Goldsmith; from the Pacific Ocean, by the United States steamer Portsmouth; from Kamtschatka, by Col. T. L. Lee; from Cuba, by Professor Poey and Professor Shepard; and from the Mauritius, by Capt. Nicholas Pike. The last-named collection is in great variety of species and admirable preservation, constituting one of the most important contributions ever made in this department to the National Museum. Professor Poey's collection is a continuation of a systematic series, which he has undertaken to supply, and which already embraces over a hundred species.

The Zoological Museum of Copenhagen has supplied models of the common form of weir used in Denmark for the capture of fishes.

The general collections of *marine invertebrates* have been from Mr. William H. Dall, from Capt. Nicholas Pike, and from the United States Fish Commission, among other series. In *mollusks* the collections of Captain Pike and Mr. Dall are especially rich.

A series of *shells* from the coast of Norway, by Mr. G. O. Sars, of Christiania, will be of much value for comparison with American forms. Numerous shells of fossil mollusks have also been received from various donors.

From the fact that the collections of *insects* have been transferred to the Agricultural Department, not much can be announced in the way of receipts in this department, all the specimens that have come to hand having been, as usual, delivered to that establishment. It may be worthy of mention, however, that the first collections made by the United States astronomical expedition for the observation of the transit of Venus, received at the Institution, consist of a series of butterflies from Brazil, furnished by Mr. Russell.

Of *plants* various packages have been received from the different Government expeditions, among them some interesting fossil species from Mr. Ambler and Dr. Stevens, of Virginia, and Mr. Sternberg, of Kansas. As heretofore, all the recent specimens have been transmitted to the Agricultural Department.

Among the more important contributions to the museum have been the specimens of *soundings* made by Commander Belknap, on the Tuscarora, during his labors in the Pacific Ocean. These are of very great

extent, and promise to furnish large numbers of new species. They are now placed in the hands of Prof. Hamilton L. Smith for identification.

A series of dredgings has been received from the vicinity of Kotzebue Sound and other portions of Behring Sea, made by Captain Smith, of the Alaska Commercial Company.

Minerals in considerable number have been received, among them a series collected by Colonel Abert, of Tennessee, specimens deposited by Mr. J. H. Jenkins, of Northumberland, specimens from Berlandier as presented by General D. N. Couch, together with specimens from Saxony, given by Dr. Endlich; these are in addition to the large gatherings of the Government expeditions.

Dr. Endlich, in charge of the mineralogical department of the museum, states that, during the year 1874, 250 minerals have been placed in the cases, in addition to those mentioned in the last report, as well as 300 lithological specimens and 150 ores.

The metallurgical collection remains about the same.

The labeling of the minerals has been finished, and exhibits a type of what the method will be when the whole collection is completed.

A large number of minerals has been examined at the request of correspondents of the Institution, and their qualitative character determined. For purposes of education the Institution furnishes qualitative determinations of mineralogical specimens, but in no case does it undertake to furnish percentages of the different components of specimens, or give certificates, for commercial purposes, of their value.

The fossils are being arranged, and in the course of a year we hope to have series of duplicates for distribution.

During the past summer, Dr. Endlich was engaged in the southwestern portion of Colorado, in the San Juan mining region, in connection with the Hayden expedition, an account of which will be given in the reports of that establishment.

It is, of course, impossible to enumerate all the collections and specimens, or to give in these cursory notes anything more than a general idea of the nature of the receipts of the year. The complete list of donors, with the objects presented by them, will be found arranged alphabetically in the appendix to the report.

Work done in connection with the National Museum.

As might reasonably be supposed, the magnitude of the receipts during 1874 has required much time and labor to reduce them to order, exceeding as they did by far those of any previous year. The rapid rate of increase is evinced by a comparison with the data for 1873 and 1872, as follows:

The total number of entries for 1874 is 564, from 337 donors, and embraces 712 packages; for 1873 the numbers are 441, 241, and 680, respectively; and for 1872, 315, 203, and 544.

As regards the distribution of duplicate specimens to public establishments, &c., the records show 320 entries; these include donations of specimens to 40 foreign museums and zoologists and to 165 home institutions, and embrace 32 sets of mammals, 18 of birds and eggs, 4 of reptiles, (living and dead,) 4 of fishes, 3 of crania, 5 of insects, 63 of shells, 12 of plants, 2 of fossils, 106 of minerals, rocks, and building-stones, 7 of ethnological specimens, and 5 of diatomaceous earths; in all, 261 lots.

A table in the appendix shows the total number of specimens distributed, including also those deposited in the care of the Department of Agriculture and the Surgeon-General's Office.

Of specimens submitted to specialists for examination and report there have been 61 lots: Mammals to H. and J. A. Allen and to Dr. Sclater; birds to Geo. N. Lawrence; reptiles and fishes to E. D. Cope; insects to Messrs. Packard, Scudder, Edwards, Ostensacken, Uhler, Ulke, Stretch, Cresson, Thomas, Glover, Emerton, and Holden; shells to Messrs. Tryon, Binney, and Sandberger; crustaceans to S. J. Smith; marine invertebrates to A. E. Verrill; plants to Messrs. Gray, Rothrock, Vasey, Englemann, Olney, James, and Carson; microscopic material to Messrs. Smith and Seaman; mineral waters to Dr. Loew.

Six lots additional to the above have been lent for study.

The number of specimens sent out for investigation is approximately estimated as follows: Mammals, 2,000; birds, 900; reptiles, 100; fishes, 100; insects, 7,000; shells, 500; marine invertebrates, 400; ethnologica, 10; packages of microscopic material, 500; plants, 9,000; in round numbers about 20,000. Some of these are included among the specimens distributed.

It is no exaggeration to say that 40,000 specimens are represented by the 320 entries in the distribution-book.

Collecting apparatus has been lent to about fifteen expeditions and collectors, principally from the stores of the United States Fish Commissioner.

GOVERNMENT EXPLORATIONS AND SURVEYS.

The following is a brief sketch of the surveys made under the authority of the General Government during the year 1874, the specimens from which are to be finally deposited in the museum under the care of the Institution.

Explorations and surveys west of the 100th meridian, First Lieutenant George M. Wheeler, Corps of Engineers, in charge.

Nine separate parties took the field in 1874 for operations in portions of Nebraska, Utah, Colorado, New Mexico, and Arizona. The point of departure was Pueblo, Colorado Territory, in the valley of the Arkansas. The whole area entered and occupied lies south of the latitude of the Spanish Peaks, except that included in special journeys necessary

to complete the triangulation commenced in 1873. This important work was delegated to Lieut. Wm. L. Marshall, Corps of Engineers, who brought to this task, besides professional and executive abilities, the experience gathered in his former labors upon this work. The total area assigned was a little less than 35,000 square miles.

Out of the nine parties, six were moving field-parties, having special areas conjoining along latitudinal and other lines, and connecting at certain triangulation and topographical stations.

A special party, under Doctor J. T. Rothrock, U. S. A., organized with a view to institute further investigations into the natural history of certain areas left unfinished in 1871, 1872, and 1873, in New Mexico and Arizona, departed from Santa Fé early in the season, and returned laden with rich and valuable collections of the flora and fauna of that great region; having carried on, in connection with their examinations, observations for altitudes of special points within the drainage area visited, throwing further light upon the geographical distribution of animal and vegetable life.

Two main distinct astronomical parties were occupied in establishing the co-ordinates of points immediately adjacent to the field of survey and others along the line of the Union Pacific Railroad, and were successful in accomplishing all that was laid out for them.

The results in the astronomical branches are, the conclusions of the observations necessary to determine the co-ordinates, and the astronomical meridian at the stations Las Vegas and Cimarron, N. Mex., the latitude of Pueblo, Col., the latitude and longitude of Sidney Barracks, Julesburgh, and North Platte Station in Nebraska, on the Union Pacific Railroad.

At the field astronomical stations sextant observations were carried on by the following officers in charge of the several parties: First Lieut. Wm L. Marshall, First Lieut. P. M. Price, Corps of Engineers; Second Lieut. C. W. Whipple, Third United States Artillery; First Lieut. R. Birnie, jr., and First Lieut. S. E. Blunt, Thirteenth United States Infantry. These stations have been numerous, answering all the requirements made upon them for checking special positions by a method in place of which nothing else could be made available.

The geodetic work included the establishment of 79 main triangulation stations, extending a net-work over the entire mountain-area occupied. Base-lines were measured at Trinidad and Pueblo, Colorado; Cimarron, Las Vegas, and Santa Fé, New Nexico. These bases control the triangulation which connects the belts of 1873 in Colorado, New Mexico, and Arizona, as well as those north and south from the line of the Union Pacific and Central Pacific Railroads.

In meteorology, except at the astronomical stations at Cimarron and Las Vegas, N Mex., the observations were conducted solely with a view to the determination of altitudes at prominent physical points within the area surveyed.

Though no person was actually assigned as geologist, Doctor H. C. Yarrow, U. S. A., and Professor E. D. Cope investigated the geology and paleontology of the Territory of New Mexico. The results obtained were highly interesting. The cretaceous beds yielded many fine fossil shells and teeth of extinct fishes, and the carboniferous limestone was found to be equally rich in specimens. A unique collection of a large number of beautifully preserved invertebrate remains was procured from the same formation. These are the deposits of a lake of a comparatively modern age, which abound in the remains of skeletons of the animals that inhabited the surrounding land. Mastodons of species quite different from those frequently found in the Eastern States were in abundance, while camels and horses had evidently existed in droves. One of the most singular discoveries was that of a deer which did not shed its horns; and the fossil remains further indicate that at this time several species of wild dogs existed to keep in check the herbivorous animals, while a large vulture, allied to the turkey-buzzard, was prepared to act as scavenger as occasion offered. In another locality crocodiles and turtles were very numerous. Among the large remains were those of the genus Bathmodon, which closely resembles the elephant in the feet and legs, but the tapir and the bear in the character of the skull. They were armed with formidable tusks, and their crania were very thick, as if designed to repel attacks.

In the line of archæology and ethnology were found the remains of ancient human dwellings which stand in lines on the summits of rocky crests, and on the more inaccessible and remote points of hills, with precipices of several hundred feet in depth on one or more sides; from these and burial places most interesting specimens of pottery, besides crania and skeletons, were obtained.

The mineralogical specimens collected have been carefully analyzed by Doctor Oscar Loew in the laboratory of the Smithsonian Institution.

Dr. H. C. Yarrow, in charge of the natural-history branch, with his assistants, have added more largely than ever before to our knowledge of the living fauna of large interior areas. Their results are soon to be worked up by themselves and other specialists, and the specimens afterwards deposited in the National Museum at the Smithsonian Institution.

As usual, a photographer accompanied the expedition, who this year was successful in obtaining special photographs of ancient ruins, of various Indian tribes, &c.

While the parties operated in the field, the office-force remained engaged in working up the results for publication.

The publications during the past year of the surveys under the War Department have been: the Progress Report of 1872, a preliminary catalogue of plants gathered in 1871, 1872, and 1873, and a preliminary report upon the ornithological specimens collected in the same years; the first in quarto, the two latter in octavo. An advance edition of the Topographical Atlas and other physical sheets was also published.

The total working-force taking the field without escorts, for the first time, was 86, including officers, assistants, and employés. The utmost harmony existed among all the parties, which largely conduced to correspondingly enhanced results. In regard to these surveys under the War Department, the following paragraph appears in the Annual Report of the Chief of Engineers to Congress: "By experience and improvements in methods and instruments, the value of the results is annually enhanced, and the cost of the work amply repaid."

It cannot fail to be gratifying to all who are interested in this class of investigations to be convinced that the proper basis for further systematic endeavor has been reached.

Survey under Professor Hayden.

This survey during the season of 1874 continued the work of 1873 westward of the 107th meridian of longitude in Colorado Territory. The entire area explored lies on the west slope of the main range of the Rocky Mountains, forming the eastern part of the drainage of the great Colorado River. The topographical and geological work included a carefully-surveyed area of about eighteen thousand square miles, much of it comprising some of the most rugged and mountainous scenery on the continent. The southern portion includes an area of nearly three thousand square miles, the greater part of which is at an elevation of 12,000 feet and upward. The first division of the party, under Mr. A. R. Marvin, operating in Northwestern Colorado, established 86 stations; the second division, under Mr. Gannett, which explored the rugged area between the Gunnison and Grand Rivers, also established 86 stations; while the third division, surveying the remarkably high country in the southwest, determined 65 stations, most of them being on peaks ranging from 13,000 feet and upward, the highest being 14,500 feet.

A fourth division, under Mr. G. R. Bechler, performed the important duty of measuring the roads, trails, passes, and carefully working up the contiguous topography, besides meandering a distance of about nine hundred miles. Mr. Bechler established 36 important stations, thus rendering more accurate and complete the general work of the survey.

A fifth party, under Mr. W. H. Jackson, the photographer, passed over the greater portion of Western Colorado, obtaining about four hundred negatives of the most characteristic scenery. These views have proved of great value in the topographical and geological studies; but the most interesting result was a series of views of the wonderful ruins in the cañons of the Mancos and Montezuma Rivers. The party found here remains of a rude civilization in the form of buildings, made of hewn stone laid in mortar. Among the ruins were various kinds of stone implements and glazed pottery, on some of which were figures of the sun. On the plains and mesas these ruins occupy considerable areas, indicating the former existence of a numerous population. In the cañons the stone dwellings are built high up in the caverns or crevices in the

sides, from 800 to 1,000 feet above the bottom, in almost inaccessible positions. From all the information that could be obtained from the present race of Indians, these dwellings were inhabited at least eight centuries ago by a race of sun-worshippers, which were driven southward, step by step, by a persistent foe from the north.

The sixth division, under Mr. J. T. Gardner, continued the primary triangulation over the mountainous region of the southwest, extending into Utah, and connecting with some of Professor Powell's stations.

The seventh division was under the immediate direction of Professor Hayden, and made special studies of those portions of Colorado that presented rather complicated problems in geology. A careful survey was made of the Elk Mountains, of the Morainal deposits in the valley of the Upper Arkansas, and the coal-beds along the east base of the Colorado range of mountains from Cañon City to Cheyenne. The season's labors were in every respect successful, and a large amount of topographical, geological, and natural-history material was secured for the eighth annual report to the Secretary of the Interior.

The publications of the survey during 1874 were the Bulletin No. 1 and No. 2, and second series, Nos. 1, 2, 3; miscellaneous publications, Nos. 3, 4, 5, 6; Cretaceous Flora, by Leo Lesquereux, 7th Annual Report, (Colorado.)

Survey under Professor Powell.

This was the continuation of the geological and geographical exploration of the basin of the Colorado of the West in Utah, prosecuted for several years previous. For this work two parties were organized, one under the charge of Prof. A. H. Thompson, and the other under the immediate direction of Professor Powell himself. Each party had a number of assistants, and to the latter was added a photographer. The first party was employed in carrying forward the work in Central Utah, and the second party in Northeastern Utah.

The valley of the Sevier, near the town of Gunnison, was selected as the proper position for the base-line from which a series of triangles could be extended to the north, east, and south, and connected with those which had been established in former years.

For hypsometric determinations Green River City on the Union Pacific Railroad, Salt Lake City, Gunnison, and Pangwitch were selected, from their connection with railway surveys, as known points of reference for altitudes to be ascertained by the barometer.

The geographical determination of latitude and longitude rests primarily on the base-line, the terminations of which were established by astronomical observations. For latitude the zenith-telescope was employed, and for longitude telegraphic methods were adopted.

The material was collected for mapping and exhibiting the resources of a section of country heretofore but little known, embracing many ranges of mountains and plateaus, with valleys drained by streams

which in places pass through deep and almost inaccessible gorges. Over the entire region surveyed the data were collected for determining the amount and distribution of lands which can be redeemed from sterility by irrigation, and also that of grass and timber lands. The coal-formations, which had been discovered in previous surveys in adjoining regions, were traced through the areas of the present survey, and many new beds discovered. It was found that the coal of Southern and Central Utah is distributed through a series of geological formations embracing most of the Tertiary and Cretaceous ages. The supply of coal of this region is, therefore, abundant, and much of it is said to be of good quality and widely distributed. The position of many of the more important mineral-lodes was determined, especially such as have been worked to a sufficient extent to enable the owners to acquire permanent titles from the Government, and these will be represented on the general map.

The geological structure of the region is exceedingly complex. A series of formations, embracing Tertiary, Mesozoic, Paleozoic, and Metamorphic rocks, are plicated on a grand scale, and displaced by faults of immense extent. During geological ages, and continued down to later periods, this region must have been the scene of great volcanic activity. Extensive fields of eruptive matter and large numbers of volcanic cones are exhibited. In many places there exist great escarpments, forming cañon-walls and lines of cliffs, exhibiting with great perfection the superposition and structure of rocks, from which interesting geological deductions can be made.

The great system of monoclinal folds and faults discovered in former years, crossing the grand cañon of the Colorado, was found to be extended into the region of this year's survey. The lithological geology was studied so far as the opportunities permitted, and large collections of rocks made, especially of the volcanic formations widely distributed in geological succession. From the sedimentary rocks fossils were obtained abundantly sufficient to indicate the ancient flora and fauna of the region. The Territory is traversed by profound gorges, which conduct off the small amount of rain-fall not evaporated. Although the amount of water carried by the streams is small, the great elevation of the country above the sea gives it the velocity of a torrent, and being mingled with stones, its erosive action exhibits effects unequalled, perhaps, in any other part of the globe. On the mountains and plateaus of this region, wherever an altitude of 9,000 feet, or more, is reached, evidences of ancient glacial action are found.

Interesting ethnological results were obtained. Two important tribes of Indians were again visited, the Ú-in-tats and Seuv-a-rits, usually known as the Uinta Utes and She-be-riches, and much additional knowledge of the words and grammatical construction of their language was secured, as also a series of facts relating to the naming of tribes and confederacies, with fresh information as to their political organiza-

tion. It so happened that while the surveyors were among these Indians, messengers arrived from the Go-si-Utes, of Western Utah and Eastern Nevada, bringing information of great rains and of the gradual rising of the Great Salt Lake, indicating, as they supposed, a great calamity, and calling upon the tribes we have mentioned to join them in religious ceremonies to appease the anger of the waters, lest in their rage and coming power they should destroy all the land and the people who lived thereon. The state of religious excitement which ensued enabled Professor Powell to increase his knowledge of their mythology and religion, in directions which previous to that time had been closed to him. On these subjects the Indians are usually reticent. Believing in sorcery and that a knowledge of their religion and organization can be used by their enemies to their disadvantage, they forbear to give any information on these subjects. But under the excitement above mentioned their reserve was neglected, and facts revealed which had previously been only partially understood. Previous to this no definite information had been obtained as to their religious worship, or whether they had any system of appeasing the displeasure of their gods.

A large number of articles to illustrate the various arts among these people, in addition to those made in previous years, was collected, so that the specimens in the National Museum for the study of the civilization of these tribes are more extensive, perhaps, than for any other on the American continent. Attention was also given to the ancient remains in the valley of the Colorado, and interesting additions have been made to the facts already known. A number of additional ruins were discovered, and observations made for depicting on a map scores of ancient towns or hamlets. Copies of picture-writings and stone implements of various kinds were obtained. The ethnological investigation embraces language, mythology, folk-lore, and the means of obtaining subsistence.

A large number of photographs was taken, which served to assist the draughtsman in delineating the topographical features of the country; also another series of the Indians themselves, intended to illustrate their dress, habits, and other characteristics.

Survey under Hon. Archibald Campbell.

This survey was for the continuation of the boundary-line along the forty-ninth parallel of latitude, between the United States and the British possessions. The distance remaining to be surveyed during 1874 was three hundred and fifty-eight miles, from longitude 106° 12′ to longitude 114° 05′. It was divided into two parties, the astronomical and the topographical.

During the season of 1874 the work was executed in the same manner as before, under the agreement made between the chief astronomers of the United States and British commissions, to the effect that the officers of the United States were to determine astronomical stations at intervals of forty miles, and to survey a belt of territory five miles wide south

of the parallel, the English to determine a similar series of astronomical stations, and to survey an equal belt of topography north of the line.

The astronomical party, in charge of Maj. W. J. Twining, was organized in Saint Paul, Minnesota, on the 1st of June, and reached the point of operation on the 1st of July. The shortness of the season, and the great distance to be traveled after the work should be completed. required that it should be finished early in September. The party was. therefore, pushed to the utmost limit of endurance, and by the 1st ot September the eight astronomical stations assigned to the United States had been determined, and the line had been connected with the last previous station of the boundary at the summit of the Rocky Mountains. In four months, this expedition accomplished a journey of 3,700 miles, besides surveying and marking 358 miles of the boundary-line.

The topographical party remained in the field both winter and summer from the 1st of June, 1873, until the present time, with the exception of two months in the spring of 1874. They have demonstrated that instrumental work can be done in that high latitude, even in the most rigorous part of the winter, where the country is wooded; but on the open plains the exposure is dangerous. That portion crossed by the line surveyed during 1874 was found to be an open plain, entirely destitute of timber, but easily practicable for wagon-trains, except in the vicinity of Frenchman's Creek and the crossing of Milk River, where wide detours had to be made to avoid the bad-lands. From longitude 106° to the crossing of Milk River the country is unattractive, the rain-fall is small, and water consequently scarce during the summer. The soil is alkaline, and produces mostly sage-brush and cactus. From the Sweet-Grass Hills to the Rocky Mountains its character is entirely changed. The rain-fall appears to be ample. The belt along the foot of the mountains, in addition to scenery of rare beauty, presents to the eye of the practical man the more solid advantage of an unsurpassed fertility. Northwestern Montana is still the range of immense herds of buffaloes, whose numbers, according to Major Twining, contrary to the commonly-received opinion, are constantly increasing. This region is the country of the Blackfoot and Piegan tribes of Indians. It is also the debatable ground of the North Assinaboines, the Gros Ventres of the prairie, and the River Crows, while an occasional war-party of the Sioux may be found as far northwest as the Sweet-Grass Hills. With the exception of the Sioux, these tribes appear to be peaceably enough disposed.

Collections and observations in natural history were made at almost every point along the boundary-line by Dr. Elliott Coues, surgeon and naturalist of the expedition, although it is to be regretted that he was not supported by an adequate corps of assistants, particularly in the departments of geology and botany. Large collections were made and sent to the Institution, an account of which is given in the report of Professor Baird. It is to be hoped that ample time may be allowed Dr. Coues for the preparation of his final report, in order that the results of

his field-work may be fully elaborated in illustration of the flora and fauna of a portion of the United States of which comparatively little is known.

MISCELLANEOUS.

The Institution, as in former years, has been in harmonious co-operation with the Department of Agriculture, the Army Medical Museum, and the Corcoran Art Gallery. With the first it has deposited plants and other articles relating to agriculture; to the Medical Museum it has transferred a large number of articles pertaining to comparative anatomy and materia medica, and has received in return ethnological specimens; in the third, the Corcoran Art Gallery, it has deposited a number of paintings, articles of statuary, engravings, &c. A list of these several deposits will be found in the appendix.

It may be mentioned that the present Secretary of the Institution has been chosen one of the trustees of the Corcoran Art Gallery, and thus the connexion between these two establishments has become more intimate. The Gallery has been opened during the past year under very favorable auspices, and bids fair to be an important means of improving the intellectual and moral condition of the citizens of Washington, as well as a perpetual monument of the beneficent liberality of its founder. Since its first opening to the public on the 19th January, 1874, it has been visited by 75,000 persons. It has an endowment of $900,000, and had an income last year of upward of $62,000.

Fog-Signals.—During the last summer I devoted a considerable portion of my vacation to investigations in regard to sound in its application to fog-signals, the results of which have been published in an appendix to the Light-House Report for 1874.

These investigations, which were a continuation of those of former years, tend to establish the fact that sound is susceptible of a kind of refraction, due to the unequal velocity of the upper and lower current of the air, by which the sound-ray is in some cases bent upward, and consequently passes far above the head of the distant auditor, and in others is refracted downward to the surface of the earth, and is thus perceived at a much greater distance. This principle explains the peculiar action of the wind on sound, as well as various abnormal phenomena which have been observed from time to time in the operation of fog-signals; also the discharge of cannon during battles, of which the sound was heard at remote points, though inaudible at those much nearer the explosion.

Fish inquiry and propagation.—It may be remembered that an act of Congress was passed in February, 1871, directing an inquiry to be made into the causes of the decrease of the food-fishes of the United States, to be prosecuted by a commissioner appointed by the President, from the civilian employés of the Government, and to serve without salary. Professor Baird, of this Institution, received this appointment and entered upon his duties.

In 1872 his sphere of labor was extended by instructions for the employment of such measures as might increase the food-fishes of the country; and reports from time to time have been made of the results of the work.

The growing interest in this subject, and the belief that the objects to be accomplished were of great importance to the country; have induced larger and larger appropriations from Congress, and the sphere of the labors of the commissioner has been extended accordingly. His work is prosecuted under two distinct heads: first, that of an inquiry into the causes of the decrease of food-fishes; secondly, that of their multiplication.

In prosecuting the inquiry referred to he has established himself at points on the sea-coast where the fisheries it was desirable to investigate are carried on, and, by inquiries on his own part and those of his assistants, he satisfied himself as to the condition of the fisheries, and the extent to which they have been diminished, and the steps to be taken for their restoration.

He has embraced the opportunity thus offered, to carry on a thorough survey of the natural history and physics of the ocean, thus doing for the coast portion of the territory of the United States what the explorations of Professor Hayden, Lieutenant Wheeler, and Major Powell are accomplishing for the Territories of the West.

His operations during the summer of 1874 were carried on at Noank, Conn., his field of investigation extending from Narragansett Bay on the east, to the mouth of the Connecticut River on the west, and to the eastern end of Long Island on the south.

As usual his presence, with the facilities at his command, attracted a large number of visitors, among them some of the most eminent naturalists of the country, who were thus enabled to carry on important researches in natural history, all of them having a more or less direct bearing upon the objects of the commission. Professor Verrill, of Yale College, has been associated with Professor Baird from the beginning of this branch of investigation, and as usual labored indefatigably during the season.

The results of the labors of 1871 at Wood's Hole have already been published in a volume which constitutes a work of standard excellence. The report for 1872 is nearly ready for publication, and that for 1873 is well advanced. The second division of his duties, that of the work of propagation of food-fishes, was directed more especially to the multiplication of the shad and salmon. Owing to the late period at which the appropriation for this purpose was available, the operations in regard to the hatching of shad were not commenced until June, when camps were successively established on the Delaware, the Hudson, and the Connecticut; that on the Hudson in connection with the fish commissioners of New York, and that on the Connecticut with the commissioners of that State.

Owing to the death of Dr. Slack, who was in charge of the station on the Delaware, very little was done on that river. On the Hudson a very considerable number of shad was obtained and distributed, apart from those introduced into the river by the State commissioners themselves. The greatest amount of the work, however, was done at South Hadley Falls, on the Connecticut River. The fish here being very abundant, many young fish were hatched and distributed, mainly under the direction of Mr. James W. Milner, to various localities in many States, extending as far west as Minnesota, south to Texas, and east to Maine, the total number thus supplied amounting to over two millions.

The operations in regard to salmon were still more satisfactory, being carried on at two establishments; one on the McCloud River, in California, under the charge of Mr. Livingston Stone, and the other on the Penobscot River, in Maine, under Mr. Charles G. Atkins. The former furnished six millions of eggs, of which one million were hatched and placed in the Sacramento River, the others being transported to hatching-houses in the East, and the young subsequently placed in the waters of the New England and Middle States, in addition to those of Maryland, Virginia, West Virginia, North Carolina, Louisiana, Texas, Ohio, Indiana, Illinois, Wisconsin, Minnesota, and Iowa.

The establishment at Bucksport, on the Penobscot, has also yielded over three million eggs. These have not yet been distributed, as they are not sufficiently far advanced, but they will be planted principally in the waters of the New England, Middle, and more northern of the Western States.

The importance of these measures for the artificial propagation of fish may be readily understood from the fact that the actual results from one pair of shad or salmon, treated artificially, fully equal those from one hundred, and, according to some, one thousand pairs, when left to perform this function naturally.

Deep-sea soundings.—Professor Baird has made a series of observations on temperatures of the sea-water at different depths, the results of which will be published in his report as United States Fish Commissioner.

The Institution has received, for investigation, from the Bureau of Navigation, Navy Department, under Commodore Ammen, a large number of specimens of deep-sea soundings, collected in the Pacific Ocean by the officers of the United States steamship Tuscarora, Commander G. E. Belknap. These specimens have been referred for microscopic examination to Prof. Hamilton L. Smith, of Hobart College, Geneva, N. Y., who has undertaken the investigation, and will report the result as soon as the work is finished.

Polaris Artic Exploration.

During the past year Dr. Emil Bessels has been engaged at the Smithsonian Institution in working up that part of the scientific material which was saved from the collections of the voyage of the Polaris in the years 1871–'73. The results of the investigations will be given in three

volumes, of which the first is nearly ready to be put in the hands of the printer. This volume contains—

Part I. Hydrography and meteorological observations at sea.

a. Hydrographical remarks relating to Baffin's Bay, Smith's Sound, and Robeson Channel.

b. Temperature of the sea and its specific gravity at different depths.

c. Ice of Smith's Sound and its motion.

d. Tidal observations made at Polaris Bay, comprising eight lunations.

Part II. Meteorology.

a. Temperature both at Polaris Bay and Polaris House, the second winter quarters.

b. Effect of the direct heating power of the sun

c. Effect of terrestrial radiation.

d. Hygrometrical observations.

e. Atmospheric pressure.

f. Winds.

g. Face of the sky.

h. Ozone.

i. Rain and snow.

Part III. Psychrometrical tables, giving the relative humidity, force of vapor, and dew-point for each tenth of a degree from 32° to —45°.

Part IV. Astronomical observations.

Part V. Magnetism and aurora.

Part VI. Pendulum experiments.

The second volume will be devoted to natural history, comprising zoology, botany, geology, palæontology, mineralogy, &c.

The third volume will comprise the ethnology of the Esquimaux.

The whole will be copiously illustrated by wood-cuts and charts, and published under the auspices of the Navy Department.*

Chemical Laboratory.—During the past two years the laboratory of the Institution has been in charge of Dr. Oscar Loew, the chemist and mineralogist of the Wheeler survey, and during this time he has made various analyses for the Institution of minerals, mineral waters, and other substances referred to the Institution for examination by the Government and other parties.

In behalf of the Wheeler expedition he has investigated and analyzed the waters of thirty-four mineral springs of New Mexico and Colorado, many soils of the arable lands of Arizona and New Mexico, rocks such as basalts, rhyolites, trachytes from New Mexico, coals of various localities in Colorado and New Mexico, lake and river deposits, minerals, such as turquois, garnets, zeolites, plants used for medicinal purposes by Mexicans, &c., &c.

Photography.—The photographic laboratory, under the direction of Mr. T. W. Smillie, has been in continued operation during the past year; a

* For the expense of the illustrations, Congress appropriated $15,000 in March, 1875.

series of photographs having been made of ethnological and natural history specimens for the use of the Institution, and a large amount of work done for others, especially for the Government surveys. The establishment of a photographic laboratory has been of great convenience to the Institution, and has been attended with but little expense. It affords at once the facility of photographing specimens and copying charts and other illustrations, while the support of the artist has been furnished by work performed for other parties.

Light-House duty.—I have been a member of the Light-House Board since its first organization, and during all this time have discharged the duties of chairman of the committee on experiments. On the resignation of Admiral Shubrick I was elected chairman of the board. I was honored with this election not entirely on account of the services I had rendered in the way of scientific investigations, but principally because I belonged neither to the Army nor the Navy, of which it was desirable that neither should claim predominance. The duty, however, pertaining to this office has been much more arduous than I anticipated. Indeed, in order that I might attend to it without interfering too much with my devotion to the affairs of the Institution, it was necessary that the board should be recalled to a previous usage, namely, that of meeting every week and transacting the principal business through its committees, instead of meeting quarterly and intrusting the operations of the establishment almost entirely to the two secretaries and the chairman, under which plan the latter was obliged to be in continual attendance at the Light-House office.

I am gratified to be able to state that, although some dissensions have occurred on account of the want of definite assignment by the original law of Congress of the relative duties of the Army and Navy while on light-house service, yet that the whole system at present is in an efficient state of activity.

It may be proper to remark that, for the labor which I have bestowed upon the light-house service for upward of twenty years, I have received no other remuneration than that which results from the conscious feeling of having successfully labored in some degree to advance the efficiency of a service which involves the protection of life and property, and is one of the benevolent institutions tending to facilitate the relations of distant countries with our own.

CONCLUSION.

From the foregoing statement it will be evident that the Institution is successfully prosecuting the plan adopted for realizing the benevolent intention of its founder in the way of increasing and diffusing knowledge among men; that its funds are again in a prosperous condition, and that its reputation and usefulness are still on the increase.

Respectfully submitted.

JOSEPH HENRY,
Secretary Smithsonian Institution.

WASHINGTON, *January*, 1875.

REPORT OF PROFESSOR HENRY, SECRETARY OF THE SMITHSONIAN INSTITUTION, FOR 1875

To the Board of Regents of the Smithsonian Institution :

GENTLEMEN : I have the honor herewith to present to your honorable board the report of the condition and operations of the Smithsonian Institution during the year 1875. In presenting this report, I am happy to be able to inform you that nothing has occurred since the close of your last session which in the least degree has interfered with the prosperity of this establishment. On the contrary, it will be manifest from the report that the Institution has continued with unabated energy to carry out the intention of its founder, as expressed in the terms of his will, by increasing and diffusing knowledge among men.

The several annual reports of the Secretary are intended to form a continuous history of the Institution, and, therefore, it is necessary to state, what is already known to the Regents, that since the date of the last report several changes have taken place in the board. Among the first of these we have to mention is that occasioned by the death of the late Vice-President of the United States, Hon. Henry Wilson. He was *ex-officio* a member of the board, and took part in the deliberations of its last session. In his death science and education have lost a warm friend, who always exerted his influence for their advancement. He ever advocated all propositions submitted to Congress for explorations and researches which might extend the bounds of knowledge. In two previous instances of vacancy in the office of Vice-President, the place in the Board of Regents was supplied first by the Hon. L. F. S. Foster, of Connecticut, and, second, by the Hon. B. F. Wade, presiding officers at the time of the Senate. In conformity with this usage, the place of Mr. Wilson will be filled by the Hon. T. W. Ferry.

The Speaker of the House of Representatives, in accordance with the law of organization of the Institution, has filled the vacancies occasioned by the expiration of the term of service of Messrs. Cox, Hoar, and Hazelton, by the appointment as Regents from the House of Representatives of the Hon. Hiester Clymer, of Pennsylvania, Hon. B. H. Hill, of Georgia, and the Hon. G. W. McCrary, of Iowa.

The operations of the Institution at present consist principally of two classes : first, of those relating to the immediate objects of the bequest, viz, the increase and diffusion of knowledge among men, through researches, publications, and exchanges ; and, second, those which pertain to the care and management of the Government collections in nat-

ural history and ethnology, constituting the *National Museum*, of which the Institution is the custodian. In regard to the latter, the operations and responsibilities of the directors have been greater than ever before. Congress, at its last session, not only made the usual appropriation of $20,000 for the care of the museum, $10,000 for cases, and $2,500 for an extension of the heating-apparatus, but also, in addition to these sums, granted $67,000 for the display of the collections of the National Museum at the Centennial Exhibition in Philadelphia. A part of this latter sum, however, was reserved for the payment of a portion of the cost of a temporary building for the exhibition of the articles belonging to the Government, leaving about $50,000 for the display by the Institution. This latter appropriation was made in connection with a series of appropriations to enable the several Departments of the Government, as well as the Smithsonian Institution, to participate in the Exhibition. Each of these parties was directed to appoint a representative, the whole forming an executive board, to which was to be given the power to control the disbursements of the appropriations; the bills to be paid by a disbursing-officer, upon vouchers certified by the respective representatives, and countersigned by the chairman of the board. Although the appropriation in question was made by Congress to enable the Institution to discharge certain duties, it was by the arrangement above mentioned relieved from all responsibility as to the expenditure of the money.

To Prof. Spencer F. Baird, Assistant Secretary of the Institution, I assigned the duty of representing it in the Government board of exhibitors. He has with much energy devoted his time and thoughts to the work, and has prepared a report, a copy of which is herewith presented, of what has been done on the part of the Institution to carry out the intention of Congress.

The results of the operations of the Institution in connection with the Centennial Exhibition will probably have a much greater effect on the future of the establishment than is at first sight apparent. The large number of specimens which have been collected by the several Departments of Government and by the Institution itself in view of this Exhibition will greatly increase the contents of the National Museum, and if we add to these the specimens which will be presented by foreign powers, of which we have already had intimations, the number will be swelled to an extent far beyond the capacity of the present building to contain them, and an additional edifice will be required for their accommodation.

In the consideration of this matter, the questions will arise whether the building required shall consist of an extension of the present Smithsonian edifice, or an entirely separate building; and these questions will involve another, viz, whether it is advisable to continue, at least without some modification, the connection which now exists between the Smithsonian Institution and the National Museum.

In regard to the first question, I may be allowed to say that as the Smithsonian Institution was compelled by an act of Congress to erect the present building, which has cost in all nearly $500,000, principally for the accommodation of the National Museum, it would now be manifestly unjust to the former establishment to transfer the specimens, as has been proposed, from the present edifice to the new building contemplated for the accommodation of the National Library. The plan, therefore, which, in my opinion, should be adopted is for the Government to take entire possession of the present edifice, making such additions to it from time to time as would be required for the care and exhibition of the increasing collections, and to repay the Smithsonian Institution for at least a portion of the cost of the building, the latter to erect a separate edifice in the vicinity, better suited to its wants, with a portion of the money thus repaid, the remainder being added to the principal of the Smithson fund.

In regard to the second question, whether the connection which now exists between the National Museum and the Smithsonian Institution should continue as it is without modification, I would say that it is desirable that a more definite distinction between the two establishments, if not an entire separation, should be made.

According to the existing arrangement, it is necessary that the Institution should apply to Congress every year for an appropriation for the support of the museum, and it is therefore presented to the world as a suppliant for perpetual aid, whereas, for carrying out the legitimate objects of the bequest, no annual appropriation is necessary from the public Treasury; for although more than one-half of the whole income of the Smithson bequest has been devoted to a museum and other local objects, it has succeeded (through its researches, its publications, and its exchanges) in establishing a reputation as extensive as the civilized world; and I doubt not, from the disposition which Congress has previously shown to faithfully discharge the duty which it has devolved upon itself in accepting the guardianship of a trust for the benefit of mankind, it will not refuse, when the public finances are in a better condition, to repay to the Smithson fund at least a portion of the amount which, through a misapprehension of the will of the founder, has been devoted to the National Museum, and also to make such separate provision for the maintenance of the latter establishment as will obviate the necessity of a constant appeal to Congress, on the part of the Institution, for aid not necessary for its own operations.

Furthermore, the museum is destined to an extension far beyond its present magnitude. It is an object of much interest to all who visit the National Capital, and is of great value as exhibiting the natural resources of the country, as well as a means of public education; and as Smithson intended the Institution founded by his bequest as a monument to himself, since he gave it his own name, it is not proper that it should be merged in any establishment of the Government, nor, on the

other hand, is the Government called upon to make annual appropriations for the advance of science to be credited to an establishment founded by an individual to perpetuate his own memory. The Smithson fund should be exclusively devoted to the increase and diffusion of knowledge among men in the manner best calculated to produce the desired effect, and its operations should be as little complicated as possible with those of Government establishments.

FINANCES.

The following is a statement of the condition of the funds at the beginning of the year 1876:

The amount originally received as the bequest of James Smithson, of England, deposited in the Treasury of the United States in accordance with the act of Congress of August 10, 1846	$515,169 00
The residuary legacy of Smithson, received in 1865, deposited in the Treasury of the United States, in accordance with the act of Congress of February 8, 1867	26,210 63
Total bequest of Smithson	541,379 63
Amount deposited in the Treasury of the United States, as authorized by act of Congress of February 8, 1867, derived from savings of income and increase in value of investments	108,620 37
Amount received as the bequest of James Hamilton, of Carlisle, Pa., February 24, 1874	1,000 00
Total permanent Smithson fund in the Treasury of the United States, bearing interest at 6 per cent., payable semi-annually in gold	651,000 00
In addition to the above, there remains of the extra fund from savings, &c., in Virginia bonds and certificates, viz: consolidated bonds, $58,700; deferred certificates, $29,375.07; fractional certificate, $50.13; total $88,125.20, now valued at	42,000 00
Cash balance in United States Treasury at the beginning of the year 1876 for current expenses	20,555 82
Amount due from First National Bank, Washington, $2,056.23, (present value unknown.)	
Total Smithson funds January 20, 1876	713,555 82

The receipts during the year were $51,388.20, and the expenditures $46,809.98, leaving a balance of $4,578.22 to be added to the balance on hand at the beginning of the year 1875.

The interest on the Hamilton bequest has been received from Feb-

ruary 24, 1874, to December 31, 1875, amounting to $118.49, which will be expended in accordance with the will of the donor.

The interest on the Virginia bonds collected during the year amounted to $4,750.11.

It was stated in the last report that at the time of the suspension of the First National Bank of Washington, (19th September, 1873,) in which the current funds had been deposited by direction of the board, there were $8,224.87 to the credit of the Institution. The following dividends have been received on this deposit: November 11, 1873, 30 per cent.; on the 7th April, 1874, 20 per cent.; on the 5th May, 1875, 10 per cent.; and on the 27th December, 1875, 15 per cent., or a total of 75 per cent., or $6,168.64, leaving a balance still due of $2,056.23.

PUBLICATIONS.

The publications of the Institution are of three classes, viz: the CONTRIBUTIONS TO KNOWLEDGE, the MISCELLANEOUS COLLECTIONS, and the ANNUAL REPORTS. The first consist of memoirs containing positive additions to science resting on original research, and which are generally the result of investigations to which the Institution has, in some way, rendered assistance. The Miscellaneous Collections are composed of works intended to facilitate the study of branches of natural history, meteorology, &c., and are designed especially to induce individuals to engage in these studies as specialties. The Annual Reports, besides an account of the operations, expenditures, and condition of the Institution, contain translations from works not generally accessible to American students, reports of lectures, extracts from correspondence, &c.

The following are the rules which have been adopted for the distribution of the several publications of the Institution:

1st. They are presented to learned societies of the first class which in return give complete series of their publications to the Institution.

2d. To libraries of the first class which give in exchange their catalogues and other publications, or an equivalent from their duplicate volumes.

3d. To colleges of the first class which furnish catalogues of their libraries and of their students, and all other publications relative to their organization and history.

4th. To States and Territories, provided they give in return copies of all documents published under their authority.

5th. To public libraries in this country, containing 15,000 volumes, especially if no other copies are given in the same place; and to smaller libraries where a large district would be otherwise unsupplied.

6th. To institutions devoted exclusively to the promotion of particular branches of knowledge are given such Smithsonian publications as relate to their respective objects.

7th. The Annual Reports are presented to the meteorological observ-

ers, to contributors of valuable material to the library or collections, and to persons engaged in special scientific research.

The distribution of the publications of the Institution is a matter which requires much care and judicious selection, the great object being to make known to the world the truths which may result from the expenditure of the Smithson fund. For this purpose, the principal class of publications, namely, the Contributions, must be so distributed as to be accessible to the greatest number of readers, and this will evidently be to large central libraries.

The volumes of Contributions are presented to institutions on the express condition that, while they are carefully preserved, they shall be accessible at all times to students and others who may desire to consult them, and be returned to the Institution in case the establishments to which they are presented at any time cease to exist. These works, it must be recollected, are not of a popular character, but require profound study to fully understand them; they are, however, of importance to the professional teacher and the popular expounder of science. They contain materials from which general treatises on special subjects may be elaborated.

The publications of the Institution during the past year have been less in number than in preceding years, but this has not been on account of want of materials, but because most of the resources of the Institution have been devoted to the completion of two volumes of the quarto series, which are nearly ready for the binder, one of which will be credited to 1875 and the other to 1876.

The twentieth volume of the Smithsonian Contributions to Knowledge will consist entirely of the discussion of a series of tabular results relative to the "*Winds of the Globe*," prepared at the expense of the Institution by the late Prof. James H. Coffin, of Lafayette College, Pennsylvania, and completed by his son, Prof. Selden J. Coffin, with the assistance of Dr. Alex. J. Wœikof, of the Imperial Geographical Society of Russia.

The twenty-first volume of the Smithsonian Contributions to Knowledge will be made up of the following papers, viz:

Statement and Exposition of Certain Harmonies of the Solar System. By Prof. Stephen Alexander, of the College of New Jersey. 4to. 104 pp.

On the General Integrals of Planetary Motion. By Simon Newcomb, professor of mathematics, United States Navy. 4to. 40 pp.

The Haidah Indians of Queen Charlotte's Island, British Columbia, with a brief description of their carvings, tattoo designs, &c. By James G. Swan, Port Townsend, Wash. Ter. 4to. 22 pp. 7 plates.

Tables, Distribution, and Variations of the Atmospheric Temperature in the United States and some adjacent parts of America. Collected by the Smithsonian Institution and discussed under the direction of Joseph Henry, Secretary. By Charles A. Schott, assistant United States Coast Survey. 4to. pp. 360. 9 diagrams, 2 plates, 3 charts.

These papers have all been described in previous reports, and, with the exception of the last, that on Temperatures, have been distributed separately to individuals and institutions especially interested in the subjects to which they relate.

The publication of the Antiquities of Tennessee, mentioned in previous reports, has been deferred in order to give the author an opportunity of revising the work and abridging it by omitting a large amount of bibliographical matter which could scarcely be published under the title of contributions to knowledge, since it is already in print. The illustrations, however, for the work have been engraved, and it will be put to press as soon as the revision is completed.

The engravings for the work on Lucernaria, by the late Prof. H. J. Clark, have been completed, with the exception of one plate, which was so badly executed that it was thought necessary to reject it. As soon as this is satisfactorily engraved, the work will be put to press and will form a part of the Contributions to Knowledge of the next year.

In the report for 1872 is given an account of a series of investigations then in progress in regard to the Tides. Beside the labor expended in this work in the line of higher mathematics, it involved arithmetical computations of a very laborious character, the expense of which was to be defrayed by the Institution. This work has been found of so much practical importance that it has been adopted as a part of the investigations of the Coast Survey. In this case, as in many others, the Institution has inaugurated valuable investigations, which have subsequently been carried on by other means. This is in accordance with the established usages of the Institution, to do nothing with its funds which can be equally well done through other agencies.

Of the octavo series or "Miscellaneous Collections," the Monograph of American Wasps, prepared by Professor de Saussure, of Geneva, Switzerland, has been completed and is nearly ready for distribution. A full account of it has been given in previous reports. It forms an octavo of 408 pages, and will doubtless be considered a valuable addition to the sources of knowledge of the natural history of this country.

Another number of the series of Miscellaneous Collections, published during the past year, is a Catalogue of the Fishes of the East Coast of North America. By Dr. Theodore Gill. It was prepared and published at first as an appendix to the report of the United States Commissioner of Fish and Fisheries for 1871–'72; but, on account of the many calls for it, and the fact that the work was prepared at the Institution, and the copies of the Government edition having been exhausted, it was thought advisable to strike off a new edition from the stereotype plates and incorporate it in the series of Miscellaneous Collections. It forms an octavo pamphlet of 54 pages.

The Botanical Index, a work mentioned in previous reports, is still in the course of preparation. It will be of much importance in enabling the botanist to find, amid the various reports of surveys made under the

direction of the United States Government and other sources of information, an account of the various plants existing in this country. The work will be prosecuted as rapidly as the time which can be devoted to it by Prof. Sereno Watson, who has it in charge, will permit; 184 pages having already been stereotyped. The cost of its preparation has been defrayed by contributions from the principal botanists of the United States, a fact which sufficiently indicates its value.

Another publication made during 1875 belongs to the Miscellaneous Collections, and is the fourth of the Toner Lecture Series. It is on "A Study of the Nature and Mechanism of Fever," by Horatio C. Wood, M. D., of Philadelphia, and contains a series of original experiments and observations on the subject.

The phenomena of fever, according to the author, will be found to be capable of being grouped in three sets: first, acceleration of the beats of the heart and disturbance of the circulation; second, nervous disturbance; third, elevation of bodily temperature. It is the opinion of the author that the first two are merely secondary and depend upon the third; *i. e.*, the essential phenomenon of fever is elevation of temperature. It forms a pamphlet of 48 pages, and has been extensively called for by the medical profession.

In order to assist in defraying the expense of the publication of the Toner Lectures, a charge is made of 25 cents for each number. As an answer to many inquiries, it may be stated in this place that the second lecture of the series has not yet been published, the Institution having failed to receive the manuscript from the author.

The preparation of the tables of the "Constants of Nature" has been in part interrupted, by the appointment of the principal author, F. W. Clarke, to the professorship of chemistry in the Cincinnati University, all his time having been absorbed in the preparation of his course of instruction. He has, however, resumed his labors on the constants, and will probably furnish us during 1876 with another installment of materials for the extension of the tables. There has been a large and increasing demand for this work, which is of much importance to the analytical chemist in facilitating his investigations.

During the past year another series of publications, which will form a part of the Miscellaneous Collections, has been commenced. It is entitled "Bulletin of the National Museum," and is intended to illustrate the collections of natural history and ethnology belonging to the United States, and constituting the National Museum, of which the Smithsonian Institution is the custodian. Of this series two numbers have been issued in octavo form, printed at the Government Printing-Office, by authority of the honorable Secretary of the Interior.

The first number is a check-list of North American Batrachia and Reptilia, with a systematic list of the higher groups, and an essay on geographical distribution, based on the specimens contained in the United States National Museum, by Prof. Edw. D. Cope. It is a contribution to

North American Herpetology, undertaken some years ago, at the request of the Institution. The materials which have been accumulating in the National Museum offer great advantages for the investigation of the anatomical structure, variation of specific characters, and geographical distribution of animals. These subjects are especially elucidated by the study of batrachians and reptiles, since these animals are especially susceptible to effects from physical influences, and are unable, like birds and mammals, to escape these by extended migrations. Their habitats, therefore, express the simplest relations of life to the special conditions under which it exists. The great number of specimens in the National Museum enables the investigator to discover the range of variations of a given species, and to reduce to the rank of varieties many which have been supposed to be distinct species—the definition of species being simply a number of individuals having physical peculiarities belonging to them alone, and at the same time found in all. Nothing is more difficult than to divide the flora or fauna of the world into distinct species, having the above characteristics, since, passing from one locality to another of varying physical conditions, the variations in form and character are so gradual that it is almost impossible to say where the line of demarkation shall be placed.

In the investigation of cold-blooded North American vertebrata, Professor Cope has found that many which have been regarded as separate species are merely geographical varieties. Bulletin No. 1 is divided into three parts.

Part I consists of an arrangement of the families and higher divisions of the batrachia and reptilia provisionally adopted by the Institution.

Part II is a check-list of the species of batrachia and reptilia of the nearctic or North American realm.

Part III relates to the geographical distribution of the vertebrata of the nearctic realm with especial reference to the batrachia and reptilia, and is divided into eleven sections.

Life in different regions of the earth presents marked peculiarities, depending in a great measure upon the geographical and topographical relations of the continents. The districts thus marked out are the Australian, the neotropical, the nearctic, or North American, the Ethiopian, the Palæological, and the Palæartic, and to these the name of "realms" has been given. The total number of species of vertebrata found in the North American realm is 2,249, which is below the truth, since many of the fishes, both of the ocean and of the fresh waters, remain undescribed. It is more difficult to give the number of species of the inferior divisions of the animal kingdom. It is stated that 8,000 species of coleopterous insects have been discovered in the same region, and that this is probably about two-thirds of the whole. Probably 50,000 is below the mark as an estimate of the number of species of insects. In relation to other realms, several species of vertebrata are common to our north-

ern regions and Europe and Asia. Thus the wolf, fox, ermine, and perhaps the beaver extend throughout the northern hemisphere. But few species are common to the nearctic and the southern neotropical realms—but one mammal and no reptiles, batrachians nor fresh-water fishes extend into Brazil, but a number of birds are permanent residents throughout both realms. Considerable variation exists in the fauna of the several parts of our region, exhibiting as many as six principal subdivisions. The warmer regions are much richer in birds, reptiles, and insects than the cooler, as we advance northward many species disappear, while a few others are added. The natural division of the eastern part of the continent is in a measure dependent on the isothermal lines which traverse it. In accordance with this fact, the following districts of the eastern region have been proposed, viz: The Carolinian; the Alleghanian; the Canadian, and the Hudsonian. The central region is characterized by the general absence of forests. It presents two divisions, each peculiar in its vegetation; the division of the plains which extends from the eastern border to the Rocky Mountains to the 100th meridian, and the Rocky Mountain region itself, which extends to the Sierra Nevada. The former is covered with grass and is almost totally treeless; the latter is covered with sage-brush.

In regard to the batrachia and reptilia, from their small amount of animal heat, it follows that temperature has the greatest influence on their life and distribution. This is exhibited not only in multiplication of forms, but in the brilliancy of color. Another important influence in regard to these animals is the amount of terrestrial and atmospheric moisture. A peculiarity of cold-blooded vertebrata of arid regions is that by means of which they readily assume the color of the body on which they rest. That a prevalent color of such bodies should lead to a habit of preference for that color is necessary, and as such habits become automatic, the permanence of the color is naturally established.

Appended to the paper is a bibliography of works and memoirs which embrace discussions of systematic or distributional relations of the reptiles of North America. Those embracing descriptions of species only, will be added in a future publication. This number forms a pamphlet of 108 octavo pages, and has been distributed to the principal museums and naturalists of the world.

The second number of the Bulletin of the National Museum is an account of the birds of Kerguelen Island, by Dr. J. H. Kidder, Surgeon United States Navy, and edited by Dr. Elliott Coues. These specimens were collected by Dr. Kidder, surgeon and naturalist of one of the parties organized for observing the transit of Venus in the southern hemisphere. The party to which Dr. Kidder was attached landed from the United States ship Swatara at the upper end of Royal Sound, a deep indentation in the southern part of Kerguelen Island, otherwise known as Desolation Island, one of the most extreme islands of the southern hemisphere. It is a region of almost constant precipitation,

only twenty-seven days out of four months being recorded as without snow or rain, and a still smaller number of nights. The range of the thermometer was not far from the freezing-point, being a little below in September and October and a little above in November and December. The violent gales, which almost constantly prevailed, and which often arise with great suddenness, rendered it dangerous to make collections in small boats. The climatic conditions greatly affect the flora and fauna of the island, there being no trees or shrubs, no plant, indeed, larger than a kind of cabbage. As a consequence of this condition, there are no land-birds or mammals strictly indigenous, and but a single shore-bird. The island is of considerable size, about ninety miles long by fifty miles wide, and is composed of volcanic rocks. No flying insects were observed except minute gnats, nor were the remains of any found in the stomachs of birds. But two species of vegetable-feeding birds were observed, all the others living exclusively on fish or marine invertebrata. An English party (also to observe the transit) established itself about fourteen miles southwest of the American station, and at about the same distance to the northwest was a German party, associated with each of which was a naturalist.

The ornithological collections made by Dr. Kidder are believed to fully indicate the character of the avi-fauna of the locality, very few species having been overlooked. The specimens possess a high interest from the fact that they are among the rarities of American museums, while most of the eggs are new to collections, if not hitherto unknown to naturalists. "The contribution to science which the specimens represent," says Dr. Coues, "is very ably complemented by Dr. Kidder's field-notes, carefully recorded upon the spot when the impressions of the observer were fresh. They possess a vigor and vividness not invariably accompanying descriptions of nature, while their entire trustworthiness is assured both by the character of the observer and by the favorable circumstances of observation." The extended biographical sketches of the Kerguelen birds will be welcomed by ornithologists as an important and interesting contribution to the life-history of these imperfectly-known species. This paper forms an octavo pamphlet of 60 pages, and has been distributed to naturalists and museums.

The first volume of the exploration of the Colorado River of the West and its tributaries, by Prof. J. W. Powell, under the direction of the Secretary of the Smithsonian Institution, has been published during the last year by the Department of the Interior. It forms a quarto volume of 303 pages with 80 illustrations and a map. It gives a history of the explorations during the years 1869, 1870, 1871, and 1872. The work to which this volume relates was originally commenced as an exploration, but was afterward developed into a survey embracing the geography, geology, ethnography, and natural history of the country. It is expected that the results of the several investigations relative to these subjects, which have been intrusted to several specialists for elabora-

tion, will in due time be published by the General Government in a style in accordance with that of the present volume. The whole work will do honor to the appreciation by the Government of scientific information of this kind, as well as of the ability and perseverance of Professor Powell and his assistants.

As an evidence of the estimation in which the labors of Professor Powell are held, it should be mentioned that he has been placed in charge of the second division of the geological survey of the Territories, under direction of the Department of the Interior, (the first division being in charge of Professor Hayden,) and that the subsequent volumes of the series of his reports will be published by that Department. It may be further mentioned that Congress has not yet ordered any extra copies of the first volume of Powell's report; those that have been printed have been published by the Interior Department. It is hoped, however, that Congress at its present session will order a new edition, granting a sufficient number of extra copies to the Smithsonian Institution to supply the principal public educational and scientific establishments of the world.

Report.—The annual report of the operations of the Institution for the year 1874, was presented to Congress as usual, and an edition of 10,500 copies printed; 2,000 of which were for the use of members of the House of Representatives, 1,000 for the use of the Senate, and 7,500 for distribution by the Institution.

The appendix to the report contains translations of eulogies on La Place by Arago, Quetelet by Mailly, De la Rive by Dumas; a lecture on tides and tidal action in harbors, by Professor Hilgard, of the Coast Survey; a translation of observations upon the electricity of the atmosphere and the aurora borealis, by Professors Lemström and De la Rive; a translation of an article on a dominant language for science, by Professor de Candolle, with notes by Dr. Gray of the British Museum; on underground temperature, by Chas. A. Schott of the Coast Survey, with the results of Professor Everett's researches on the same subject for the British Association for the Advancement of Science; on the earthquakes in North Carolina in 1874, by Professor du Pre, with notes by Professor Henry; a translation of Professor de la Rive's report on the transactions of the Geneva Society of Physics and Natural History for 1872 and 1873; the translation of the conclusion of an extensive and important paper, by General Morin of France, on warming and ventilation, with numerous illustrations; and a large number of original communications on ethnology, describing the antiquities of different parts of the United States.

This report, as usual, has been distributed to various educational establishments, to the Meteorological observers, and other contributors to the objects of the Institution, and to such persons as have made special application for them in writing.

Indian vocabularies.—During the year a number of Indian vocabula-

ries have been received from different persons engaged in explorations in the Territories. These have all been referred to J. H. Trumbull, LL. D., of Hartford, Conn., for critical examination and arrangement for the press.

A full list of all the manuscript Indian vocabularies in possession of the Institution will be given in a subsequent report. We hope during the next year to commence the publication of the extensive collection of materials of this character, so important to the labors of the ethnologist.

RESEARCHES.

Meteorology.—In the beginning of 1874 the meteorological system of records by voluntary observers, which had been in operation by the Institution for twenty-five years, was transferred to the Signal-Office of the War Department, under General A. J. Myer. This transfer was made in accordance with the general policy of the Institution, viz, that of abandoning any field of enterprise as soon as the work could be done as well through other agencies. This transfer has received the approbation of the observers generally, who, while they are now co-operating with the Signal-Service, still keep up a correspondence with the Institution on subjects of general scientific interest. The meteorological system of the United States under General Myer is in an admirable condition. The total number of daily reports filed at the Office of the Chief Signal-Officer are now as follows: Number of daily-service simultaneous telegraphic reports, 109; number of international daily simultaneous reports, 268; number of reports of voluntary observers, 393; number of reports of medical corps of the Army, 102; number of reports of medical corps of the Navy, 5; making a grand total of 877 daily reports received regularly for discussion. Such an extensive series of observations, if continued for twenty years, will furnish the data for determining the peculiar climatology of North America with a precision hitherto unknown in the history of meteorology. The labors of the Smithsonian Institution in the line of meteorology are now principally confined to working up the materials in this branch of science, which it has collected during the last quarter of a century. These materials include not only the observations of the Institution itself, but all that could be obtained from other sources relative to North America, from the first settlement of the country down to the present time. The first work of this class which has been published is that of the rain-fall. It included all the materials which had been collected down to 1866. During the last two years preparations have been made to publish a new edition of this work, including the additions from new materials, and with new maps on a larger scale. In the preparation of this new edition we have received important assistance, through the politeness of General Myer, from the system of the Signal-Service.

The work published by the Institution on the rain-fall of the United States is of great importance in relation to our agricultural resources,

to the various engineering enterprises which are proposed from time to time, as well as to the manufacturing interests of the country. It is also intimately connected with the subject of forest-culture, which at present is occupying a large share of public attention. It must be the basis of all the improvements which are attempted in regard to irrigation, and is of especial value in this respect to the western portion of the United States.

There are two great systems of rain-bearing winds in North America; that from the west on our Pacific coast, which blows across the several chains of mountains, constituting the western system, precipitating its moisture principally on the western slopes of the mountains, so that on the eastern sides of these mountains, as well as on the slopes and plains east of the Rocky Mountains, there are arid portions of scanty vegetation, on account of deficient moisture. How far these may be rendered fertile by irrigation depends upon the amount of rain-fall and the conformation of the surface by which the water may be utilized. The other system of rain-winds is from the Gulf of Mexico and the Atlantic. These winds blow principally in the direction of the axis of the Appalachian system of mountains, and consequently precipitate their moisture along the valleys and on both sides of the mountain slopes, covering the whole region with fertility. In connection with this subject we would commend to public attention the plan adopted by the State of Maine in making a hydraulic survey of the whole State, to ascertain the amount of water-power available for manufacturing purposes.

In view of the limited, though in this country comparatively great, quantity of coal-power, it is our duty to use, in preference in all cases where it is possible, water-power, which is constantly renewed and must be continued as long as the sun's energy elevates water from the surface of the ocean and precipitates it on the higher portions of the land. We have in the falls of Niagara a source of active energy, which we doubt not in the course of years will be utilized to an extent which shall affect the well-being of man in every part of the civilized world. The time of the utilization of this power will depend upon the varying price of coal. When this, from the constantly-increasing demand, assumes a certain price, water-power will more generally be resorted to and the large amount of energy which is now dissipated, as in the case of the falls of the Potomac and other rivers, will be carefully husbanded.

The next work of the same class is that of the *Winds of the Globe*, comprising the results of the discussions of not only observations made under the direction of the Institution in the United States, but of those of every other part of the world of which the records were attainable. This work has been prepared by the joint agency of the late Prof. Jas. H. Coffin, of Lafayette College, Pennsylvania, and the Smithsonian Institution, the former furnishing the general plan and oversight of the work, the latter contributing the greater part of the material and

defraying the cost of making the reductions and numerical computations.* This work may be considered an extension of the Winds of the Northern Hemisphere, prepared by Professor Coffin, and published by the Institution in 1853. It is designed to show principally—

First. The mean direction in which the lower currents of the atmosphere move over all parts of the surface of the earth.

Second. The ratio that the progressive motion bears to the total distance traveled.

Third. The modification that the currents undergo in different seasons of the year.

Fourth. The direction in which the forces act that produce these modifications.

Fifth. The amount of intensity of these forces as reckoned on the same scale as that which determines their mean annual direction.

The data used for elucidating these points consist of series of observations of winds made at 3,223 different stations on land and during numerous voyages at sea, extending from the parallel of 82° 16′ north to beyond the parallel of 75° south latitude, altogether embracing an aggregate period of over eighteen thousand five hundred years. The whole material is arranged in the form of tabular series, and for convenience in discussion the entire surface of the earth is divided into thirty-six zones by parallels of latitude drawn five degrees asunder, commencing at the North Pole and proceeding southwardly. The method of reduction is not that which has usually been adopted of obtaining the prevailing direction or the point from which the wind blows most frequently, but the traverse of the whole is made out in the same manner as that of a ship at sea. Suppose a particle of air to start at a given point and to move with uniform velocity for nine days, viz, from the northeast for a period of three days, southeast four days, south two days, at the end of this time the particle will be found at a certain point; the distance from the starting-point and the direction of the line joining the ending-points will be formed by a traverse. In this way the resultant direction of the wind is determined for a given place. If no deflecting force was exerted, the mean direction and relative progress of the wind would be the same for each month of the year; but as this is not the case, by comparing different resultants, an idea of the deflecting force is obtained, or, in other words, of the *monsoon* influence which tends in different seasons of the year to vary the resultant direction.

At the time of the death of Professor Coffin in 1873, the principal series of tables was mainly completed, yet there were blanks left to be filled. The supply of these deficiencies and the preparation of the illustrative plates was undertaken without pecuniary compensation by his son and successor in Lafayette College, Prof. Selden J. Coffin, who executed the work with a feeling of pious regard for the memory of a venerated parent, interest in science, and a devotion which merits special commendation.

*Altogether 80 persons were engaged in these reductions, the principal assistant of Professor Coffin being Mr. Henry Mansfield, a skilful computer.

The Institution also availed itself of the meteorological knowledge and skill in investigation of Dr. Alex. Woeikof, of the Imperial Geographical Society of Russia, during his late visit to this country, for a series of deductions from the tables and charts which the untimely death of Professor Coffin prevented him from undertaking.

Perhaps one of the most important additions to the meteorology of the present day is the establishment of the dependence of the force and direction of the wind upon the pressure of the atmosphere at different points. This subject was especially studied by Professor Espy and Professor Coffin, in this country, and by Professor Buys Ballot, in Holland, and later by Professor Buchan, in Edinburgh. This relation may be expressed as follows: *At the surface of the earth the wind blows from a region of high pressure to a region of low pressure, and is deflected to the right owing to the rotation of the earth; while in the region above a reverse wind, deflected to the left, is taking place.* Professor Buchan has rendered great service to meteorology by extending this law to the general phenomena of the winds of the globe. For example, during the winter months the land becomes cold by radiation below the temperature of the sea, and, consequently, the air is more condensed over the former than over the latter, the barometer stands higher, and currents of air in accordance with the law in question tend to pass at the surface of the earth from the land to the ocean, and in an opposite direction above, while the reverse phenomena take place in summer.

It is fully established that there are on the surface of the earth five systems of winds, which roughly correspond with the zones of climate and temperature, and that the boundaries of these systems vary in latitude with the change in declination of the sun. In the torrid zone the resultant of the wind is from an easterly direction toward a variable middle line, giving rise to what are called the trade-winds. In the temperate zones the average direction of the wind is from the west; and again, in the arctic and antarctic regions, the resultant is from an easterly direction; and, furthermore, the limits of these systems of winds are connected with regions of high or low barometer. Thus, in the equatorial regions, the barometer above the middle line is below the average height of 30 inches, while along the northern and southern limit of this region there is a belt of high barometer, and again on the northern and southern limit of the winds of the temperate zone there is a belt of low barometer. The direction of the wind in these several regions and the belt of high and low barometer are referred to the unequal action of the heat of the sun in rarefying the air at the equator, causing an indrawing current at the surface of the earth, which takes a westerly direction on account of the revolution of the earth on its axis, and a current toward each pole, which, from the same reason, has a direction from the west. The equatorial current, cooling above, descends by its superior weight at the northern limit of the trade-winds, producing the belt of high barometer, from which, in opposite directions, two currents move, one

returning toward the equator, forming the trade-wind, and the other, proceeding northward, having a westerly component by the revolution of the earth, tends to move in a direction from the west. It is probable, however, that a portion of the upper wind from the equator flows entirely to the pole, and there, by cooling, descends, consequently having a north-easterly direction. The point of union of these two currents produces an upward motion, again giving rise to the northern belt of lower barometer.

This sketch of the direction of the wind at the surface of the earth is shown by Professor Coffin to exist by deductions from actual observations, while it is also proved by Professor Ferrel, of the Coast Survey, as a mathematical deduction from the theory of a fluid subjected to difference of temperatures at different parts on the surface of a rotating globe.

The material which Dr. Woeikof has supplied to this work consists in an elaborate comparison of the actual winds, as tabulated from the reductions of Professor Coffin, with the varying pressure of the atmosphere at different seasons of the year due to the relative variation of the heat of the land and of the sea, on the principle adopted by Buchan. The result of his labor gives a satisfactory account in all cases where the pressure has been determined of the perturbations in the direction and intensity of the wind in different seasons of the year; and is a valuable first approximation to a full analysis of the causes of the complex phenomena of the local and periodical changes in the atmosphere.

The results given in the tables of the whole world are represented and illustrated by twenty-six plates drawn by Prof. S. J. Coffin, and engraved by Henry Chandler, of Buffalo, N. Y. These plates present, at a single view, the relation of the different parts of the same system of winds to each other and to the different systems of the globe. For the illustration of the deductions of Dr. Woeikof, two plates are reproduced from the paper of Professor Buchan in the Transactions of the Royal Society of Edinburgh. We trust this work will be accepted by the scientific world as a monument to the memory of Professor Coffin, and as an illustration of the judicious policy of the Smithsonian Institution.

The extended series of tables relative to the *Temperature* of the United States which has been in progress of preparation for a number of years, is now nearly through the press, and will be ready for distribution in the course of 1876.

This memoir contains the results of all observations to the end of the year 1870, from the following sources:

1st. The registers of the Smithsonian Institution, embracing upward of 300 folio volumes.

2d. The joint publications of the Institution, the Patent-Office, and the Department of Agriculture.

3d. All the publications and unpublished records of the meteorological system of the United States Army.

4th. The records of the United States Lake Survey under the Engineer Department of the United States Army.

5th. The records of the United States Coast Survey under the Treasury Department.

6th. The volumes compiled by Dr. F. B. Hough from observations made under the direction of the Regents of the University of the State of New York.

7th. The records made in Pennsylvania under the direction of the Franklin Institute of Philadelphia.

8th. The transactions of various societies and periodical publications.

All the material collected was first classified, and a series of tables of temperature in detail constructed, and from these were deduced the consolidated tables of average temperature. The first of these series, owing to its great bulk, must at present remain in manuscripts; it can, however, at any time be consulted at the Institution. The series of tables which is now about to be published consists of average temperatures, and is sufficient for the study of the climate of the United States generally, or for any particular part of it, as far as it depends upon temperature. The whole work was done under the superintendence of Mr. Charles A. Schott, of the United States Coast Survey, who has also given special attention to the revision of the accuracy of the computations. The character of Mr. Schott for scientific knowledge, sagacity, and skill, as exhibited in the previous publications on meteorology by the Institution, gives assurance that the present work on the temperature is a valuable contribution to knowledge.

Perhaps the best idea of the character and extent of the work can be given in a brief space by the following extract from the table of contents:

Section I.—General remarks and explanations of tabular results.

Special table of corrections for daily variation of temperature in each month and the year, for every hour and for various combinations of hours.

Tables of mean temperature for each month, season, and the year, at various stations, principally in North America.

Graphical representation and explanation of the isothermal charts.

Deductions from the charts of the distribution of the mean annual temperature, and of the distribution of the temperature during the winter and the summer seasons.

Section II.—Discussion of the daily fluctuation of the atmospheric temperature.

Times of sunrise and sunset in different latitudes and for every tenth day in each month.

Tables of bi-hourly, hourly, and semi-hourly mean temperatures for each month and the year at various places in North America.

Tables of differences from the mean of the day, of bi-hourly, hourly, and semi-hourly mean temperatures for each month and the year.

Systematic representation of the daily fluctuation of the temperature, by means of a periodic function.

Analysis of the daily fluctuation.

Variability of the temperature at any hour of the day from the normal value of that hour.

Section III.—The annual fluctuation of the temperature expressed in terms of a periodic function.

Table of computed annual fluctuation of the temperature at forty-six stations.

Discussion of the results for dates of mean annual values and for maxima and minima; and annual range in connection with the geographical distribution of the stations.

Examination into alleged interruption in the regularity of the annual fluctuation at certain epochs, with tables of temperature of each day of the year, deduced from a series of years.

Investigation of the variability of the temperature of any one day in a series of years.

Inequality in the epoch of the minima and maxima of the annual fluctuation.

Tables of observed extremes of temperatures, arranged by months, for a selected number of stations.

Analysis of tabular results for greatest heat and greatest cold with regard to geographical distribution.

Extreme annual range of temperature and monthly absolute variability; exhibition of the law of annual distribution.

Tables of the mean annual temperature, principally in the United States, for a succession of years from the earliest records to the close of the year 1870.

Investigation of the secular variation of the annual mean temperature, and of the permanency of the climate.

Comparison of the secular variation of the temperature with the variations in the frequency of the solar spots.

Comparison of the secular variation in the temperature and rain-fall in the United States.

Comparison of the secular variation in the temperature with the average annual direction of the wind.

Range of variability in the secular variation of the annual temperature.

Secular variation in the annual minima and maxima, compared with the variation in the annual means.

The tables in the first section contain the number and name of each station, its latitude and longitude, its elevation above the sea, its mean temperature for each month and for each season, and for the whole year, the extent of the series, the observing hours, and the name of the observer. In cases where observations were made at hours of the day differing from those of the general series, they were reduced to uniformity by corrections derived from tables of observations made at each hour of

the twenty-four, continuously for a number of years. Such tables were furnished by the observations at Toronto, Mohawk, New Haven, and Philadelphia. The tables of this section will be of much importance to those interested in meteorology, as furnishing data for the special climatology of the various portions of the United States. The institution has been frequently applied to by State authorities, agricultural and medical societies and others, for information as to the temperature of peculiar localities, which can now be more readily supplied than before the tables were printed.

The tables of the second section relate to the daily fluctuation of the temperature during the year. The regular variations of the temperature due to changes in the sun's altitude and the length of the day are affected by perturbations from day to day on account of aqueous vapor suspended in the atmosphere, by the serenity or cloudiness of the sky, and by the direction of the wind. As a general rule the maximum heat occurs some time after the sun has reached his greatest altitude, and the greatest cold somewhere between midnight and sunrise. Even in midwinter in high latitudes, during the continued absence of the sun, these periodic fluctuations are still perceptible; which may be accounted for by supposing waves of heat transported from more southern regions where the sun still rises above the horizon.

The tables of the third section relate to the annual fluctuations of the temperature and the perturbations from the curve derived from observations made during a series of years. These are of importance in determining questions as to the secular changes in climate.

The work is illustrated by three charts of isothermal spaces, one for summer, another for winter, and the third for the year; also two plates and a number of wood-cuts.

The next series of meteorological observations which remains to be discussed and analyzed is that which relates to the pressure of the atmosphere, which, it is evident from what has been said in regard to the winds, is an important element in determining the peculiar climatology of the North American Continent and its relation to that of the other parts of the world. This work will be commenced during the latter part of the present year.

Another work will be continued—that on the collation and discussion of the observations on thunder-storms and other casual phenomena. The observations in regard to these phenomena have been copied from the original records and arranged in tables previous to their discussion.

The miscellaneous work done by our computers in regard to meteorology during the year 1875 is as follows:

Manuscript temperature tables were prepared for the first seven months of 1871 and for March, 1872, these records not having been accessible before. Many additions were made to the general tables from new material sent by observers and others. The collection and tabulation of the observations for rain-fall at the Smithsonian stations for 1874 has

been completed, and also for those at the Signal-Service stations by permission of General Myer, Chief Signal-Officer, from 1872 to 1874 inclusive, also for Army stations for the last six months of 1874, and for Canadian stations from 1872 to 1874 complete.

For the exhibition of the results of the meteorological labors of the Institution at the Centennial Exhibition, an outline map 16 by 12 feet has been prepared. This map will be of use to the lecturer and to the different departments of the Government in exhibiting on a large scale the results of various statistical inquiries. Already a number of different parties have applied for copies, for which such a charge will be made as to considerably diminish the cost to the Institution of the original production of the map.

INTERNATIONAL LITERARY AND SCIENTIFIC EXCHANGES.

This system has been prosecuted during the past year with unabated energy, and the results have been commensurate with the labor expended. As an evidence of the high estimation in which this branch of the operations of the Institution is regarded, as well as to give proper credit to the parties who have transmitted free of cost the packages of the Institution, we reprint, as usual, the following list of their names:

Cunard Steamship Company.
Anchor Steamship Company.
Pacific Mail Steamship Company.
Panama Railroad Company.
Pacific Steam Navigation Company.
New York and Mexico Steamship Company.
New York and Brazil Steamship Company.
North German Lloyd Steamship Company.
Hamburg American Packet Company.
French Transatlantic Company.
North Baltic Lloyd Steamship Company.
Inman Steamship Company.

The special thanks of the Institution are again tendered to the above-mentioned companies for their enlightened liberality.

It should also be mentioned that Messrs. Prin, Trowand & Co., of New York, agents of the Atlas Steamship Company, have made a very liberal concession to the Institution in the reduction of charges for transmission of parcels to the West Indies; one dollar in gold being charged for any package not exceeding three cubic feet in measurement, instead of the usual charge, three times this sum.

The following are the foreign centers of reception and distribution of the Smithsonian exchanges:

London—William Wesley, 28 Essex street, Strand.
Paris—G. Bossange, 16 rue du 4 Septembre.
Leipsic—Dr. Felix Flügel, 49 Sidonien Strasse.
St. Petersburg—L. Watkins & Co., 10 Admiralty Place.
Amsterdam—F. Müller. Heerengracht kk, No. 130.

Milan—U. Hoepli, 591 Galeria Cristoforia.
Harlem—Prof. Baumhauer.
Christiania—Royal University of Norway.
Stockholm—Royal Swedish Academy of Sciences.
Copenhagen—Royal Danish Society.
Lisbon—Royal Academy of Sciences.
Madrid—Royal Academy of Sciences.
Havana—Dr. Felipe Poey.
Santiago—University of Chili.
Mexico—Mexican Society of Geography and Statistics
Montreal—Geological Survey of Canada.

The packages of the Institution for the West Indies have been kindly forwarded by Mr. Thomas Bland, of New York, and those for Turkey and some other points by the American Board of Commissioners for Foreign Missions, Boston.

The following table exhibits the number of foreign establishments with which the Institution is at present in correspondence, or, in other words, to which it sends publications and from which it receives others in return:

Foreign Institutions in correspondence with the Smithsonian Institution.

Australia	29	India	31
Argentine Republic	13	Java	5
Algeria	6	Japan	4
Belgium	110	Liberia	1
British America	27	Mexico	14
Bolivia	1	Mauritius	4
Brazil	8	New Zealand	14
British Guiana	3	Norway	24
Central America	1	Polynesia	2
Chili	9	Portugal	21
Colombia	3	Philippine Islands	2
Cape Colony	5	Peru	3
China	1	Russia	161
Denmark	28	Spain	14
Dutch Guiana	1	Sweden	21
Ecuador	2	Switzerland	68
Egypt	8	St. Helena	2
France	290	Syria	1
Germany	642	Turkey	11
Greece	8	Venezuela	2
Great Britain and Ireland	350	West Indies	7
Holland	65	General	6
Iceland	2		
Italy	177	Total	2,207

Statistics of exchanges sent during the last seven years.

	1869.	1870.	1871.	1872.	1873.	1874.	1875.
No. of boxes	112	121	108	179	196	131	208
Bulk in cubic feet	1,033	1,189	772	954	1,476	933	1,503
Weight	23,376	31,383	28,950	26,850	44,236	27,990	45,300

We may also mention as an evidence of the high appreciation of the character of the Smithsonian exchanges, that the packages bearing the marks of the Institution are admitted free of duty and without examination into all foreign ports.

The value of this system, as a means of advancing civilization, can scarcely be too highly estimated. Accounts of all the results of scientific investigations in the old and new world are through it interchanged, and men in both hemispheres are rendered efficient co-operators in the great work of enlarging the bounds of knowledge, and thus one great impediment to human advancement, that of isolation, is, in a measure, overcome.

The system has now become so extended that it requires the constant attention of several assistants and a large amount of correspondence. It has, however, been reduced to such general regulations as usually to prevent loss or the missending of packages. It has happened in a few cases that loss has occurred on account of shipwreck, and among these we have to mention that of the four large cases shipped from Germany in December last, on the Deutschland, three of which contained recent publications of German learned societies, and the fourth specimens of ornithology for the National Museum. The latter alone was insured. In connection with this loss we have received the following expression of regret from Dr. Felix Flügel, the warm friend and for more than twenty years efficient agent of the Institution:

"It is now a disagreeable thought that I hurried the transmission of the last case as much as possible, in order to insure its being forwarded by the unfortunate vessel. I feel quite sorry that I cannot any longer boast that not a single leaf intrusted to my care for your Institution had been lost."

During the past year 4,661 packages, each containing several articles, have been received from abroad for distribution to institutions and individuals in this country.

Two hundred and eight boxes, averaging 7 cubic feet each, with a total weight of 45,300 pounds, were sent abroad by the Institution during the year. The total number of separate parcels contained in these boxes was about 12,000.

To facilitate the business of the exchanges, the following rules have been adopted:

1. Every package, without exception, must be enveloped in strong

paper, and secured so as to bear separate transportation by express or otherwise.

2. The address of the institution or individual, for whom the package is intended, must be written legibly on the cover, and the name of the sender on one corner of the same.

3. No single package must exceed the half of a cubic foot in bulk.

4. A detailed list of addresses of all the parcels sent, with their contents, must accompany them.

5. No letter or other communication can be allowed in the parcel, excepting such as relates exclusively to the contents of the package.

6. All packages must be delivered in Washington free of freight and other expenses.

7. Every parcel should contain a blank acknowledgment, to be signed and returned, either through the agent of the Institution, or, what is still better, through the mail, to the sender.

Should returns be desired for what is sent, the fact should be explicitly stated on the list of the contents of the package. Much disappointment is frequently expressed at the absence of any return in kind for transmissions; but unless these are specifically asked for, they will fail in many instances to be made. It will facilitate the labors of the Institution very greatly if the number corresponding to the several addresses in the Smithsonian printed catalogue be marked on the face of each parcel; and for this purpose a copy of the catalogue will be forwarded to all who apply for it.

Specimens of natural history will not be received for transmission unless with a previous understanding as to their character and bulk.

8. Unless all these conditions are complied with, the parcels will not be forwarded from the Institution; and, on the failure to comply with the first and second conditions, will be returned to the sender for correction.

In regard to exchanges we have to state, at the request of the Societé Americaine de France, 20 Rue Madame, Paris, that it will gladly exchange its publications with societies especially devoted to the archæology of the New World. We are also requested to announce that the Royal Society of New South Wales desires to enter into correspondence with similar scientific societies and institutions in other countries, for the purpose of making a friendly interchange of information and publications. The annual transactions published by this society consist of original scientific articles, which usually relate to the geography, geology, mineralogy, natural history, meteorology, and general resources of the colony of New South Wales.

The materials of exchanges are in some cases furnished by special acts of Congress. As an example of this, we may state that at the last session it was ordered that one thousand copies of the Report of the Geological Survey of the Territories, by Dr. Hayden, for the year 1873, be furnished to the Smithsonian Institution. These will be distributed to foreign societies during the coming year.

EXCHANGE OF GOVERNMENT DOCUMENTS.

In 1867 a proposition was made to the Institution, by the Librarian of Congress, relative to establishing a system of exchange of official documents between the Government of the United States and those of foreign nations.

The object in this was to secure regularly and systematically all reports and other documents relative to the legislation, jurisprudence, statistics, internal economy, technology, &c., of all nations, so as to place the material at the command of the committees and members of Congress, heads of bureaus, &c.

In accordance with this, a circular* was addressed to the different governments having relations with the United States, for the purpose of ascertaining their views as to such an exchange.

The following governments responded favorably: France, Belgium, Great Britain, Switzerland, Spain, Costa Rica, Netherlands, Chili, Denmark, Argentine Confederation, United States of Colombia, Würtemburg, Finland, Hamburg, Baden, Sweden, Victoria. The latter government forwarded a collection of books at once, which was placed in the Library of Congress.

At the Thirty-ninth session of Congress, the following resolution was adopted:

[No. 55.] A RESOLUTION to provide for the exchange of certain public documents.

Resolved by the Senate and House of Representatives of the United States of America, in Congress assembled, That fifty copies of all documents hereafter printed by order of either house of Congress, and fifty copies additional of all documents printed in excess of the usual number, together with fifty copies of each publication issued by any Department or Bureau of the Government, be placed at the disposal of the Joint Committee on the Library, who shall exchange the same, through the agency of the Smithsonian Institution, for such works published in foreign countries, and especially by foreign governments, as may be deemed by said committee an equivalent; said works to be deposited in the Library of Congress.

Approved March 2, 1867.

In consequence of an oversight in not ordering the Public Printer to furnish the necessary extra copies of public documents for this purpose, the Library Committee could not carry out the foregoing resolution, and at the ensuing session, Fortieth Congress, the following additional resolution was adopted:

[No. 72.] A RESOLUTION to carry into effect the resolution approved March two, eighteen hundred and sixty-seven, providing for the exchange of certain public documents.

Resolved by the Senate and House of Representatives of the United States of America, in Congress assembled, That the Congressional Printer, whenever he shall be so directed by the Joint Committee on the Library, be, and he hereby is, directed to print fifty copies, in addition to the regular number, of all documents hereafter printed by order of either house of Congress, or by order of any Department or Bureau of the Government, and whenever he shall be so directed by the Joint Committee on the Library,

*Report of the Smithsonian Institution for 1867, page 71.

one hundred copies additional of all documents ordered to be printed in excess of the usual number; said fifty or one hundred copies to be delivered to the Librarian of Congress, to be exchanged, under direction of the Joint Committee on the Library, as provided by joint resolution approved March two, eighteen hundred and sixty-seven.

SEC. 2. *And be it further resolved,* That fifty copies of each publication printed under direction of any Department or Bureau of the Government, whether at the Congressional Printing-Office or elsewhere, shall be placed at the disposal of the Joint Committee on the Library, to carry out the provisions of said resolution.

Approved July 25, 1868.

The following is the provision in relation to the subject in the Revised Statutes:

SEC. 3796. The Congressional Printer shall, when so directed by the Joint Committee on the Library, print, in addition to the usual number, either fifty or one hundred copies, as he may be directed, of all documents printed by order of either house of Congress, or of any Department or Bureau of the Government. [Revised Statutes.]

The exchange proposed by this action of Congress, from unforeseen difficulties, has never been fully carried into effect, although several attempts have been made to do so.

In October, 1874, by special direction of Mr. Spofford, Librarian of Congress, four cases of documents were sent to the government of Ontario, Toronto; and in November, 1874, five cases to the Parliamentary Library, Ottawa, five cases to the government of Japan, and four cases to the Bibliothek des Deutschen Reichstag, Berlin.

A number of boxes were also shipped to the agents of the Institution in Europe, to be held by them for further instructions.

A large quantity of these public documents having accumulated at the Institution, it became necessary to provide for their distribution without further delay, and accordingly the Institution issued, in October last, the following circular:

The Congress of the United States has authorized the exchange, under direction of the Joint Library Committee of Congress, through the Smithsonian Institution, of a certain number of all United States official documents for the corresponding publications of other governments throughout the world; the returns to be placed in the National Library at Washington. The works to be distributed consist of reports and proceedings of Congress, messages of the President, annual reports and occasional publications of Departments and Bureaus, &c., the whole relating to the legislation, jurisprudence, foreign relations, commerce, statistics, arts, manufactures, agriculture, geography, hydrography, &c., of the United States, and including everything, of whatever nature, published, either by direct order of Congress or by any of the Departments of the Government. The series embraces a large number of volumes each year, the most of which are bound.

The exchange expected from each government is a complete series of its publications, to include the documents of special bureaus or departments as well as the general publications, of whatever nature, printed at the public expense, and also embracing all such works as are published by booksellers with the aid of grants or subscriptions from governments.

The Smithsonian Institution, in behalf of the Joint Library Committee of Congress, is prepared to deliver the publications of the United States, free of charge for freight, to any person in the city of Washington or in New York who may be designated by the governments which enter into the arrangement.

The books intended for the United States are to be delivered to either of the Smithsonian agents, viz:

London, William Wesley, 28 Essex street, Strand; Paris, G. Bossange, 16 rue du 4 Septembre; Leipsic, Dr. Felix Flügel, 12 Sidonien Strasse; St. Petersburg, L. Watkins & Co., 10 Admiralty Place; Amsterdam, F. Müller; Milan, U. Hoepli, 591 Galeria Cristoforia; Haarlem, Bureau Scientifique Central Neerlandais à Harlem; Christiania, Kongelige Norske Frederiks Universitetet; Stockholm, Kongliga Svenska Vetenskaps Akademien; Copenhagen, Kongelige Danske Videnskabernes Selskab.

For all other countries, packages may be delivered to the United States ministers. An invoice of each transmission should be sent by mail to the Institution.

JOSEPH HENRY,
Secretary Smithsonian Institution.

This circular was sent with the following letter to the foreign ministers in Washington representing the following countries: Argentine Republic, Austria-Hungary, Belgium, Brazil, Chili, Denmark, France, German Empire, Great Britain, Guatemala, Hawaii, Hayti, Italy, Japan, Mexico, Netherlands, Peru, Portugal, Russia, Salvador, Spain, Sweden and Norway, Turkey, United States of Colombia, Venezuela.

SMITHSONIAN INSTITUTION,
Washington, D. C., October 30, 1875.

SIR: I have the honor, accompanying this, to transmit a circular relative to the exchange of the documents published by the United States with those of other nations, and to request you to state to whom the boxes now ready for transmission, intended for your government, shall be delivered.

Very respectfully, your obedient servant,

JOSEPH HENRY,
Secretary Smithsonian Institution.

In accordance with the instructions received by the Institution in response to the foregoing letter, the following distribution of documents was made:

6 cases for Turkey, sent to legation, H street, Washington, D. C.

6 cases for France, sent to consul-general of France, New York.

6 cases for Portugal, sent to consul-general of Portugal, 148 Pearl street, New York.

6 cases for Sweden, sent to consulate, 18 Exchange Place, New York.

6 cases for Brazil, sent to vice-consul, 52 South Gay street, Baltimore.

6 cases for Argentine Republic, sent to G. Videla Dorna, Albermarle Hotel, New York.

4 cases for Belgium, sent to Peter Wright & Sons, Philadelphia.

1 case for Chili, sent to Muñoz & Espriella, 52 Pine street, New York.

6 cases for Mexico, sent to Juan N. Navarro, 50 Exchange Place, N. Y.

When these boxes had been distributed we were requested by the Librarian of Congress to stop further proceedings until instructions could be procured from the Library Committee. As soon as the difficulties which have impeded this work are removed, the Institution will go on to complete the arrangement.

LIBRARY.

The library of the Institution, as has been stated in previous reports, is deposited in the Capitol of the United States, with the Librarian of

Congress, under whose direction it is arranged and catalogued as a part of the Library of the Government.

The following is a statement of the books, maps, and charts received in 1875:

Volumes:		
Octavo, or less	819	
Quarto, or larger	301	
		1,120
Parts of volumes:		
Octavo, or less	2,139	
Quarto, or larger	1,877	
		4,016
Pamphlets:		
Octavo, or less	1,524	
Quarto, or larger	273	
		1,797
Maps and charts		114
Total receipts		7,047

These articles are entered as they are received at the Institution in a large record-book, and afterward transferred to the Library of Congress. The number received in 1875 was considerably larger than that in the preceding year.

During the past year much use has been made of the books of the Institution which are in the Library of Congress as well as those of the latter library by the collaborators of the Institution. The value of the library will, however, be enhanced when the new edition of the catalogue of transactions of learned societies has been published, the old edition having been deficient in the names of the works received since the date at which it was issued.

The following are some of the more valuable works received in 1875:

From the Ministry of War, St. Petersburg: Artillery Journal, 1868–1874, 37 parts; Engineering Journal, 1868–1873, 27 parts; Ordnance Magazine, 1868–1874, 14 parts.

From His Highness the Maharajah of Travancose, Trevandrum: Observations of Magnetic Declination, made at the Trevandrum and Augustia Observatories in the years 1852 to 1869. Vol. I. London, 1874. 4to.

From the British government: Fac-similes of National Manuscripts of Ireland, selected and edited under the direction of the Right Hon. Edward Sullivan, Master of the Rolls in Ireland, by J. T. Gilbert, Secretary of the Public Record Office of Ireland, and photozincographed by command of Her Majesty Queen Victoria, by Major-General Sir Henry James. Part I. Dublin, 1874. Folio.

From the University of Chili, Santiago: Anales 1872, 1873. Government Documents, 12 volumes and six parts. Topographical and Geological Chart of Chili, in 13 parts.

From the Ambrosian Library, Milan: Codex Syro-Hexaplaris Ambrosianus photolithographice editus curante et adnotante sac. obl. Antonio Maria Ceriani. Milan, 1874. Folio.

From the publishers, Paris: Revue des Cours Littéraires, 1863–1874; Revue des Cours Scientifiques, 1863–1874, 28 vols. 4to.

From the Royal University of Norway, Christiania: The Cathedral of Throndheim. Christiania, 1859. Folio. Die Pflanzenwelt Norwegens. Christiania, 1873–1895. 4to. Magnetism der Erde von Christopher Hansteen. 4to, with folio atlas. Christiania, 1819. Norges Melodier, arrangerede for pianoforte med text. Kjöbenhavn. 8vo. Die Aegyptischen Denkmäler in St. Petersburg, Helsingfors, Upsala, und Copenhagen, von J. Lieblein, mit 35 autographirten Tafelu. Christiania, 1873. 8vo. Norges Mynter i Middelalderen af C. A. Holmbre. Christiania, 1865. 4to. Geologisk Kart over det söndenfjeldske Norge af Dr. Kjenelf. Meteorologisk Storm-Atlas af H. Mohn. Christiana, 1870. Folio. Denkmale der Holzbaukunst in Norwegen. Folio. Noske Nationaldragter af C. Tonsberg. Christiania. 4to. Portola Sögur, ved C. R. Unger. Christiania, 1874. 8vo. Remains from the Iron Age of Scandinavia, by O. Montelius. Stockholm, 1869. 4to.

From Mr. James L. Bowes, Liverpool: Keramic Art of Japan. By George Ashdown Auderley and James Lord Bowes. Parts I and II. Illustrated. London and Liverpool, 1875. Folio. Also descriptive catalogue of art works in Japanese lacquer, 1875. 4to.

From the Public Library of Buenos Ayres: Government documents, scientific, historical, biographical and poetical works, 68 volumes, 114 parts of volumes, and 35 pamphlets.

From the Royal Library, Stockholm: Government documents, 100 volumes.

From the Bureau of Statistics, Stockholm: Bidrag till Sveriges Officiela Statistik, 24 parts, 4to, and Notices sur la Suède. Stockholm, 1875. 8vo.

From the Finnish Scientific Society, Helsingfors: 9 volumes of their publications.

From the Universities of Dorpat, Helsingfors, Berlin, Bonn, Breslau, Erlangen, Freiburg, Göttingen, Halle, Heidelberg, Jena, Leipzig, Marburg, Rostock, Basel, and Zürich: Inaugural dissertations for 1874.

From the Library of Parliament, Ottawa, Canada: 15 volumes government documents.

From the Board of Admiralty, London: 26 charts published by the Hydrographic Office, from January, 1874, to January, 1875. The Admiralty Catalogue of Charts, Plans, &c., 1875; Catalogue of the Admiralty Library, 1875; and 10 lists of lights.

From the State Library of Illinois: 16 volumes State documents.

From the State Library of Vermont: 9 volumes State documents.

From Sir Charles Hartley, in behalf of the European Commission of the Danube: The second volume of lithographed plates of surveys, &c.,

of the commission, with descriptive texts. The first volume of this very valuable and important work was presented to the Institution some years ago by Baron d'Offenberg, the late Russian Minister at Washington.

Among the most interesting works presented is that of the first part of the series of fac-similes of the National Manuscripts of Ireland. The art of photozincography was invented by Maj. Gen. Sir Henry James, in 1860, and in 1866 he was ordered to produce five hundred fac-simile copies of Domesday Book, and afterward a series of national manuscripts to illustrate the changes in the English language and writing since the time of the Conquest. The publication of the first series in four volumes was finished in 1869. The government then concluded to have a series of documents of a similar character produced from the Scotch Records, with translation, which was finished in 1872. Her Majesty's government next authorized the publication of a series from the Irish Records, the first part of which, with all the other series, has been received by the Institution. The English series of fac-similes contains a great number of extremely valuable historical manuscripts of various kinds—legal, diplomatic, and epistolary. The Scotch series consists mainly of copies of a large number of royal and other charters and important state papers. The Irish series is remarkable not only for the great antiquity of many of the manuscripts comprised in it, but also for the splendid examples of pictorial art which it contains.

Among the articles presented to the library is a photograph of an Egyptian papyrus, about 40 feet in length, from Mr. John S. Edgar, United States consul at Beirut, Syria, discovered in December, 1874, in a previously unopened tomb at Thebes, Egypt.

It is proper to state, in connection with the library, that the following act of courtesy to the Regents of the Smithsonian Institution, residing in Washington, was passed by Congress March 3, 1875: "That the Joint Committee of both Houses of Congress on the Library be authorized to extend the use of books in the Library of Congress to Regents of the Smithsonian Institution resident in Washington on the same conditions and restrictions as members of Congress are allowed to use the Library."

TELEGRAPHIC ANNOUNCEMENT OF ASTRONOMICAL DISCOVERIES.

The important arrangement which was concluded between the Smithsonian Institution and the Atlantic cable companies in 1873, by which free telegraphic transmission of astronomical discoveries was granted between Europe and America, has been continued during the past year.

The following is a list of the *asteroids* discovered in 1875:

No. 141, discovered by Paul Henry, at Paris, January 13.
No. 142, " by J. Palisa, at Pola, January 28.
No. 143, " by J. Palisa, at Pola, February 23.
No. 144, " by C. H. F. Peters, at Clinton, June 4.
No. 145, " by C. H. F. Peters, at Clinton, June 4.

No. 146, discovered by A. Borelly, at Marseilles, June 8.
No. 147, " by Schulhof, at Berlin, July 11.
No. 148, " by Prosper Henry, at Paris, August 7.
No. 149, " by Perrotin, at Toulouse, October 6.
No. 150, " by Watson, at Ann Arbor, October 18.
No. 151, " by Palisa, at Pola, November 1.
No. 152, " by Paul Henry, at Paris, November 2.
No. 153, " by Palisa, at Pola, November 2.
No. 154, " by Prosper Henry, at Paris, November 4.
No. 155, " by Palisa, at Pola, November 8.
No. 156, " by Palisa, at Pola, November 22.
No. 157, " by Borelly, at Marseilles, December 1.

CORRESPONDENCE.

The correspondence of the Institution continues to increase from year to year. Not only are there upward of 2,000 foreign institutions that require acknowledgments for works presented to libraries, or for specimens to the museum, but there are also an increasing number of individuals in different parts of the old and new worlds who, through the institution, make inquiries as to subjects connected with various branches of knowledge relative to America.

In this country the public generally consider the Institution as an establishment to which requests may be addressed asking information on all branches of knowledge, the solution of various scientific problems, the examination and indorsement both of scientific investigation and crude unscientific speculations. In the line of mathematics during the past year, we have had communications the object of which was the duplication of the cube, the quadrature of the circle, and the tri-section of an angle, in which the writers confidently anticipated that no flaw could be found in their reasoning; and indeed in some cases much labor was required to point out the fallacy. But the most troublesome correspondents are persons of extensive reading, and in some cases of considerable literary acquirements, who in earlier life were not imbued with scientific methods, but who, not without a certain degree of mental power, imagine that they have made great discoveries in the way of high generalizations. Their claims not being allowed, they rank themselves among the martyrs of science, against whom the scientific schools and the envy of the world have arrayed themselves. Indeed, to such intensity does this feeling arise in certain persons that on their special subjects they are really monomaniacs, although on others they may be not only entirely sane, but even evince abilities of a high order. This mental condition is not confined to our country. A notable example of it is found in the case of the celebrated German poet, Goethe, who, examining a dark patch on a white wall through a prism, saw the upper and lower edges of the dark figure bordered with the colors of the rainbow. On this observation he founded a theory of colors,

which included the idea that blackness was a compound of all colors, and that the ordinary theory, which had been propounded by Newton, was an absurdity. So thoroughly did he become imbued with this conception that it was in vain to attempt to convince him of its fallacy, and he was irritated almost to madness when the name of Newton was mentioned with commendation.

In this connection we may mention as a somewhat singular coincidence, that at the beginning of this Institution the author of this report was called upon to examine a paper, presented for publication by a professor in one of the most prominent universities of this country, in which the author had adopted as an original suggestion the same hypothesis as that of Goethe, and whose indignation on account of its rejection was expressed in terms of little courtesy. Two persons of this class have recently made a special journey to Washington, from distant parts of the country, to demand justice from the Institution, in the way of recognition of their claims to discoveries in science of great importance to humanity, and each of them has made an appeal to his Representative in Congress to aid him in compelling the Institution to acknowledge the merits of his speculations.

Providence vindicates in such cases the equality of its justice in giving to such persons an undue share of self-esteem, and an exaltation of confidence in themselves, which in a great degree compensate for the want of what they conceive to be the just appreciation of the public. Unless, however, they are men of great benevolence of disposition, who can look with pity on what they deem the ignorance and prejudice of leaders of science, they are apt to indulge in a bitterness of denunciation which might be injurious to the reputation of the Institution were their effects not neutralized by the extravagance of the assertions themselves. The representatives of this class of persons are increasing with the increase of the diffusion of popular knowledge.. It must not be understood that this remark is made to disparage the diffusion of scientific knowledge, but simply to indicate that there are classes of minds of a peculiar idiosyncrasy which tend to expend their power in unconditioned and unfruitful speculation; neither do we condemn scientific speculation, for the discovery of all great principles of science is the result of antecedent hypotheses or speculations, which are, however, founded on definite analogies of the known, and finally adopted or rejected by the test of the exact agreement of predictions based upon them with the actual phenomena of nature.

During the past year a number of communications have been received in regard to the discovery of new motive-powers as to which extravagant ideas have been entertained relative to superseding coal-power as an element for the propulsion of machinery. In regard to these, we may say that science has established the great fact, without the possibility of doubt, that what is called power, or that which produces changes in matter, cannot be created by man, but exists in nature in a

state of activity or in a condition of neutralization; and furthermore, that all the original forces connected with our globe, as a general rule, have assumed a state of permanent equilibrium, and that the crust of the earth as a whole, with the exception of the comparatively exceedingly small proportion, consisting of organic matter, such as coal, wood, &c., is, as it were, a burnt slag, incapable of yielding power; that all the motions and changes on its surface are due to actions from celestial space, principally from the sun These are comprised under the heads of wind-power, water-power, tide-power, and heat-power as developed in the combustion of coal. Beside these there are no indications of any other motive-powers. It is true, the heat of the interior of the earth may hereafter be utilized—that wind, water, and especially tide power may also be more generally employed than at present. Great improvements are possible also in the application of coal-power; the present steam-engine is exceedingly wasteful of useful effect, and the perfection of the air-engine is much to be desired.

The application of the direct heat of the sun to produce motive energy can scarcely ever compete with the indirect application of this power through growing plants and the subsequent combustion of the fuel which they furnish.

All attempts to substitute electricity or magnetism for coal-power must be unsuccessful, since these powers tend to an equilibrium from which they can only be disturbed by the application of another power, which is the equivalent of that which they can subsequently exhibit. They are, however, with chemical attraction, &c., of great importance as intermediate agents in the application of the power of heat as derived from combustion.

Science does not indicate in the slightest degree the possibility of the discovery of a new primary power comparable with that of combustion, as exhibited in the burning of coal. Whatever unknown powers may exist in nature capable of doing work, must be in a state of neutralization, otherwise they would manifest themselves spontaneously, and from this state of neutralization or equilibrium they can only be released by the action of an extraneous power of equivalent energy, and we therefore do not hesitate to say that all declarations of the discovery of a new power which is to supersede the use of coal as a motive-power, have their origin in ignorance or deception, and frequently in both. A man of some ingenuity in combining mechanical elements, and having some indefinite scientific knowledge, imagines it possible to obtain a certain result by a given combination of principles, and by long brooding over this subject, previous to experiment, at length convinces himself of the certainty of the anticipated result. Having thus deceived himself by his sophisms, he calls upon his neighbors to accept his conclusions as verified truths, and soon acquires the notoriety of having made a discovery which is to change the civilization

of the world. The shadowy reputation which he has thus acquired is too gratifying to his vanity to be at once relinquished by the announcement of his self-deception, and in preference he applies his ingenuity in devising means by which to continue the deception of his friends and supporters long after he himself has been convinced of the fallacy of his first assumptions. In this way what was commenced in folly generally ends in fraud.

The records of the Patent-Office of this country exhibit a greater amount of thought and ingenuity employed in the way of invention than perhaps in any other country, but for want of more definite conceptions of scientific principles, an immense amount of labor is expended in futile attempts to produce results which are unattainable.

Another branch of the correspondence relates to questions in regard to the naming of objects of natural history, and especially to specimens of mineralogy. The interest which is felt in regard to the mining-products of the country induce large numbers of specimens of ores to be submitted to the Institution for examination. The rule adopted in regard to these, is to give the results of a qualitative analysis, that is, an enumeration of the substances contained in each specimen, without giving the percentage of each. This information can be given without very much labor for a single specimen, whereas an exact quantitative analysis would require more time than the Institution can devote to an inquiry which may be of commercial value to an individual, but of no especial interest to the public at large. When information as to the percentage of ingredients is required, the party is referred to some expert who will make the examination desired for a proper compensation. This distinction in the kind of information furnished is necessary to prevent the name of the Institution from being connected with transactions of a character which have been injurious to the reputation of those concerned in them.

In carrying on the correspondence, much assistance has been rendered by the collaborators of the Institution.

ETHNOLOGY.

From the commencement of the Institution to the present time, the archæology of the United States has been to it an object of special interest. In all cases in which information has been received of the locality of a field of probable interesting discovery, an appropriation has been made for its ethnological explorations. The articles obtained from such sources have been deposited in the National Museum, with the intention of having descriptions and discussions of them published in the Smithsonian Contributions to Knowledge. The archæology of the United States has not been the only part of ethnology to which attention has been given, but also special effort has been made from the first to obtain illustrations and descriptions of the now-existing native inhabitants of the North American continent. This latter subject is very important in

furnishing the materials for ascertaining the uses of the implements of the Stone Age found in the ancient mounds, since many of them with perhaps slight modification are in use at the present time among the more remote Indians of the western portion of this country. For example, pointed stone implements found in the mounds which have been thought to be arrow and javelin points, are now employed as knives, to which wooden handles are attached by means of a vegetable cement, and from the transmission of usages we may confidently assume that similar handles, long since decayed, were also originally attached to like implements of undoubted ancient origin.

The subject of ethnology has received a very great impetus through the appropriation of Congress for the display of illustrations at the Centennial, circulars having been distributed, requesting the correspondents of the Institution to aid in collecting specimens and to give information as to the existence of special collections, from which unique specimens could be borrowed for copying in plaster. The Institution has also engaged the services of Dr. Rau, of New York, the well-known ethnologist, to classify and arrange the whole collection in the National Museum, and to prepare a descriptive catalogue for publication. He has commenced with the classification of the specimens of the Stone Age, and has nearly completed this part of the general work. In this classification it has been thought proper to separate the objects belonging to times anterior to the occupation of the continent by Europeans, from those which have been used since that period. The first archæological series more particularly comprises objects found in mounds and other burial-places of early date, in caves, shell-heaps, &c., or, in other words, those which cannot with certainty be ascribed to tribes still in existence, or which have become extinct within historical times.

The second, or more strictly ethnological, series, consists of objects obtained from existing native tribes, and contains almost every article tending to illustrate the domestic life, hunting, fishing, games, warfare, navigation—in short, every phase of Indian existence that can be exhibited by tangible objects.

An account of what has been added to this department will be found in the report on the Museum by Prof. Baird, and also in the Appendix.

MISCELLANEOUS.

The Institution, as in former years, has been in harmonious co-operation with the Department of Agriculture, the Army Medical Museum, and the Corcoran Art Gallery. With the first it has deposited plants and other articles relating to agriculture; to the second it has transferred a large number of articles pertaining to comparative anatomy and materia medica, and has received in return ethnological specimens; in the third, the Corcoran Art Gallery, it has deposited a number of engravings.

The Secretary of the Institution being one of the trustees of the Art-

Gallery, the connection between the two establishments is not only cordial, but of an intimate character. The gallery during the year has been enriched by a large collection of rare plaster-casts, copies of the principal statues of the Vatican, and has been visited by a large number of citizens and strangers as a source of refined pleasure, and by a number of persons as means of practical improvement in art. We learn with pleasure that Mr. Corcoran, in addition to his munificent gifts to the city of Washington, is making provision for a series of art-studios, which cannot fail to add to the refined culture of the national capital.

Chemical laboratory.—During the past three years the laboratory of the Institution has been in charge of Dr. Oscar Loew, the chemist and mineralogist of the Wheeler survey; and during this time he has made various analyses for the Institution of minerals, mineral-waters, and other substances referred to the Institution for examination by the Government and other parties.

In behalf of the Wheeler expedition he has investigated and analyzed the waters of twenty different thermal springs, mineral springs, and alkaline lakes of Southern California; soils of arable lands and of the desert of Southern California; saline efflorescences from numerous localities in the Mohave desert, and ores and rocks from the same locality.

Photography.—The photographic laboratory, under the direction of Mr. T. W. Smillie, has been removed to the new building erected expressly for its accommodation and for the use of the taxidermists and naturalists engaged in preparing specimens for the Centennial Exhibition. A large number of photographs have been made of ethnological and natural history specimens for the use of the Institution, and a large amount of work done for others, especially for the United States Fish-Commission and Government surveys.

The Institution has been engaged for several years in collecting photographic likenesses of distinguished cultivators of science in all parts of the world, of the meteorological observers who for many years furnished valuable records of their observations, of the contributors to the ethnological department of the National Museum, of and other correspondents of the Institution. Of these photographs, four hundred have been received, which are neatly framed and form an interesting feature of the collections.

Light-house duty.—I have been a member of the Light-House Board since its first organization, and during all this time have discharged the duty of chairman of the committee on experiments. On the resignation of Admiral Shubrick in 1871, I was honored by an the election as chairman of the board. In the discharge of the duties connected with this service, I usually devote one day in the week and the greater proportion of my summer vacation. It may not be improper for me to remark that for the labors which I have thus bestowed upon the light-house service for upward of twenty years, I have received no other remuneration than

that which results from the consciousness of having labored somewhat successfully in advancing the efficiency of a service which is one of the benevolent institutions of the present day tending to facilitate the harmonious intercourse of nations widely separated by intervening oceans.

During the last summer I devoted the entire vacation to the investigation of sound in its relation to fog-signals, the results of which have been published in the report of the Light-House Board for 1875. These investigations were a continuation of those of former years, and tend to establish the facts previously obtained, as well as to extend the knowledge of the phenomena of sound in its application to the uses of the mariner.

In these investigations the following conclusions have been arrived at:

1. That the rays of a beam of sound do not, like those of a beam of light, move parallel to each other from the surface of a concave reflector, but constantly diverge laterally on all sides, and although at first they are more intense in the axis of the reflector, they finally spread out so as to encompass the whole horizon, thus rendering the use of reflectors to enforce fog-signals of little value.

2. That the effect of wind in increasing or diminishing sound is not confined to currents of air at the surface of the earth, but that those of higher strata are also active in varying its transmission.

3. That although sound is generally heard farther with the wind than against it, yet in some instances the reverse is remarkably the case.

4. That sound may be heard in some cases at a greater distance, while it is inaudible at a less distance from its origin.

5. That a distant sound may be heard at the top of a tower in some cases when it is inaudible at the bottom.

6. That sound experiences a refraction deflecting it, in some cases, in a horizontal direction, and in others in a vertical plane, which explains most of the phenomena above-mentioned.

The results obtained have excited considerable interest in this country and in Europe, and have given rise to criticism and discussions which will tend to enlarge and diffuse the knowledge of this important subject.

I have also, in behalf of the Light-House Board, made a series of experiments on petroleum as a light-house illuminant. These experiments were in continuation of those which I had previously made in regard to the introduction of lard-oil. Previous to the establishment of the Light-House Board, sperm-oil had been exclusively used in our system of light-houses, but the expense of this gradually increased from year to year until it became as high as $3 per gallon. After a laborious series of experiments, it was found that, under certain conditions, lard-oil might be substituted, and as this could be purchased at the time for from 50 to 60 cents per gallon, a saving of more than a hundred thousand dollars per annum was the result of the change. At the same time, a

series of investigations, was made in regard to petroleum, but at that period the only refined petroleum submitted to the board after advertisement was that of a volatile character, and too dangerous to be adopted for light-house purposes. Since then, however, the price of lard-oil has constantly increased, while refined petroleum can now be obtained of such a character as to be safely employed by ordinary light-house keepers. Its introduction, therefore, in regard to economy, is a matter of much importance. But great care must be exercised in selecting oil of a proper quality, and hence the necessity of a thorough knowledge of its peculiarities in regard to safety.

In the investigations on this subject, it was ascertained that the fire-test usually employed to establish the character of a given oil in reference to safety was not in itself sufficient to settle this question. Many of the oils in general use, which, at the temperature of the atmosphere, increased by that from the burning of the lamp, give off a vapor which, if suffered to accumulate and mingle with the air in the space above the oil in the reservoir, produces a mixture which, if in definite proportion, explodes with the violence of gunpowder. It is true, on the doctrine of chances, an explosion may seldom take place, but still, the conditions necessary are frequently present, and only requires the application of a flame to produce a disastrous effect.

Although the discovery of the petroleum wells of Pennsylvania has been an immense boon to humanity, yet the advantage gained from it has been dearly bought by the accidents which have resulted from its incautious use. Its sale ought to be regulated by rigid enactments of legislatures, and none suffered to be sold which exhales a vapor capable of producing an explosion when mixed except at a temperature much above that at which the lamp is subjected in the warmest period of the year.

Fish Commission.—The investigation in regard to food-fishes and the methods of their propagation, for which an appropriation for several years has been annually made by Congress, has been continued under the direction of Professor Baird. This work was commenced in 1872, and has been prosecuted with satisfactory results to the present time. The species to which special attention has been given are shad, the fresh-water herring, the striped bass or rock-fish, the California salmon, the salmon of Maine, the land-locked salmon, the white-fish, and the carp, each of these having special relations to certain portions of the country, and promising in their anticipated aggregate an extremely important addition to the food-resources of the United States.

The States which have, up to this time, been the recipients of spawn and young fish are thirty-two in number. The extension of the benefit to other States, and its amplification in all, is simply a question of time and expenditure. The subject of fish culture is one of general popularity, as is evinced by the appointment of fish-commissioners in nineteen States, in most instances for the purpose of direct co-operation with the United States Commission.

The importance of the subject may be inferred from the fact that it may be stated, without exaggeration, that the waters bordering our shores can be made to yield a larger percentage of nutriment, acre for acre, than the land. Indeed, fish culture is the only efficient means by which the fertilizing ingredients of the soil, which are constantly carried into the ocean by sewage, can be reclaimed for the reproduction of nutriment to organized beings. By want of a reclamation of this kind, certain portions of the earth thickly inhabited in ancient times have become sterile and almost deserted.

For the purpose of giving an idea of the nature and extent of the operations of the United States Fish Commission, Professor Baird gives the following statement, showing the distribution of fish during the years 1874 and 1875:

Of young shad	18,689,550
Of Penobscot salmon	2,294,565
Of California salmon	4,581,340
Total young fish	25,565,455

To this is to be added the hatching and distribution, during the winter and spring of 1875–'76, of California salmon, Penobscot salmon, land-locked salmon, and lake white-fish, not yet completed, amounting to at least fourteen million fish, thus making a total of forty million fish supplied by the United States Fish Commission in three years. This, at the assumed ratio of 1 to 200, would represent the proceeds of eight thousand million of eggs laid in the natural way, and subject to all the perils of natural spawning.

Polaris expedition.—Dr. Emil Bessels during the year has continued his labors at the Institution on the scientific materials which were saved from the Polaris expedition to the Arctic regions in the years 1871–'73, with the exception of two months in the summer, which were devoted to an attempt to make an exploration of Alaska in the United States steamer Saranac. He was, however, unfortunately shipwrecked and lost all his outfit. The first volume of the scientific results of the Polaris Expedition, relating to astronomy, pendulum experiments, temperature, winds, psychrometer, solar radiation, terrestrial radiation, ozone, face of the sky, meteorology, those taken at sea, &c., has been printed, and makes 793 pages. The volume will contain 960 pages, 14 plates, 2 maps, and 40 wood-cuts. Volumes II and III are under preparation, the former being devoted to natural history, comprising zoölogy, botany, geology, palæontology, mineralogy, containing about 250 pages, 10 plates, and 30 wood-cuts; the latter will comprise a complete monograph on the Eskimo, illustrated by a hundred plates and 300 wood-cuts. Of the former, 35 are ready to be engraved; of the latter 122 are drawn and 74 are engraved. The expense of preparation of this work and of the illustrations is defrayed by an appropriation of $15,000 by Congress at its last session.

NATIONAL MUSEUM.

The National Museum was established by the Government in 1842, and consisted of the specimens collected by the Wilkes exploring expedition. It was transferred from the Patent Office to the care of the Smithsonian Institution in 1858, where it has been enlarged by all the collections made by exploring and surveying parties of the several bureaus of the War, Navy, Treasury, and Interior Departments, and those of the Smithsonian Institution.

At first, $4,000 were allowed by Congress for the care and exhibition of the specimens. This sum has been gradually increased to $20,000. Nothing, however, has been allowed for the rent of the building, which was erected exclusively out of the income from the bequest of Smithson.

The following report from Prof. SPENCER F. BAIRD, Assistant Secretary, gives an account of the additions to the Museum and the various operations connected with it during the year 1875:

Increase of the National Museum.—The year 1875 constitutes a marked epoch in the history of this establishment, the increase in the number and comparative value of the specimens received, as also the work done in connection with the same, being much greater than that of any previous year. This is due partly to the natural increase year by year, which has been experienced since 1865, but more particularly as the result of special efforts made to prepare a suitable exhibition of the natural history and ethnology of the country at the International Exhibition of 1876.

For the purpose of enabling the Institution to exhibit a satisfactory display of the mineral, animal, fishery, and ethnological condition of the country, an appropriation was made by Congress of $67,000, subject, however, to a deduction for the erection of a building and the preparation of the surrounding grounds for that occasion. As this amounted to about $17,000, the sum actually available was $50,000. In addition to this, $5,000 was appropriated for the department of the food-fishes.

As many important gaps existed in the collection of American animals, speedy efforts were made to procure such as were wanting, or to replace such as were in bad condition.

The object of the exhibition in question was to present the industrial relations and applications of American natural history and geology; and as this had been entirely neglected previously, it became necessary to commence from the beginning and study out a plan of operations after determining the general character of the exhibit that was to be made. With this view, a series of circulars was prepared on the different subjects, and sent to all the correspondents of the Institution, accom-

panied with special directions for collecting, packing, and shipping, as also a schedule of classification.

The mineral department was first organized, and was placed in charge of Prof. William P. Blake, an experienced mining-engineer and geologist. In this work he was assisted by Mr. Thomas Donaldson, who had charge of the collecting of the gold and silver ores of the West, and of which he secured a very complete and exhaustive representation.

The department of the animal products and of the fisheries was placed more particularly in Mr. Goode's charge; and that of ethnology assigned to Dr. Rau. For fuller details of what has been done in this and other branches, I refer to my special report to you.

As the general result of the agencies that have been set in motion, I may state that the contributions in 1875 amounted to over one thousand in number, embracing nearly two thousand packages, from four hundred and sixty-four different parties, this being, as already stated, far in excess of those of any previous year.

I present herewith a list of these donations, arranged alphabetically, and to which I refer for additional details, the aggregate being too great to permit the systematic plan of presentation of previous years.

Under the head of Mammals, the most important addition to the stock is that of the series of skins of the fur-seal and sea-lion, presented by the Alaska Commercial Company, twenty specimens of the former and five of the latter constituting the contribution. To this company the Smithsonian Institution is under many obligations, not only for securing and sending the skins, but for acting as its agent in San Francisco for the transaction of its business, connected with the transmission of supplies to its correspondents and the forwarding to Washington of their collections. From Mr. Charles E. Aiken, of Colorado, several specimens of mountain-buffalo and other animals have been received. Capt. James Gilliss has supplied the black-tailed deer; Colonel Brockett, a fine elk; Mr. P. T. Barnum, specimens of various animals that have died in his menagerie, such as the eland, giraffe, sea-lion, ostrich, &c. Rev. R. R. McLeod, of Houlton, Me., has furnished nearly all the mammals of Maine, such as the caribou, the beaver, the porcupine, the fisher, the marten, &c.

Of birds, the more especial contributions are a series of fine specimens from Mr. S. C. Bowman, a skin of the Honduras turkey from Mr. F. E. Sarg, and a collection of Alaskan species from Mr. Lucien M. Turner.

Numerous small lots of reptiles and amphibia have been received from various gentlemen, and will be found enumerated in the list.

Of fishes, the most important special collections are a series of the fishes of Norway from Mr. Robert Collett, and those gathered by the United States Fish Commission; types of South American fishes, from C. R. Lütken; collections from the vicinity of Newport, by Mr. Samuel Powel; and from Gloucester, by J. S. Whitman; from California and Oregon, by Mr. Livingston Stone, &c.

Of the fresh-water and land shells, all the collections were placed in charge of Dr. James Lewis for arrangement, and occasion was taken to issue a special circular, asking contributions to this department. Many responses were made to this invitation, and the collection thereby greatly increased.

Other invertebrates were secured by the efforts of the United States Fish Commission, and through correspondents.

The department of ethnology has been especially enriched in consequence of the desire to render the Centennial display a success. In this the co-operation of the Indian Bureau of the Department of the Interior has been of the greatest importance. Among the most valuable acquisitions in this department have been the collections of Mr. Paul Schumacher and his party on the mainlands and the islands adjacent to Santa Barbara, as also those of Rev. Stephen Bowers in the same neighborhood. Collections of less magnitude were also made by Mr. Schumacher in Oregon. The Alaska Commercial Company presented a series of nine mummies from Kagaymil Island of the Aleutian group, and one from Prince William's Sound, all of much ethnological interest, being the first specimens of the kind ever received from Alaska.

The traditions respecting the Aleutian mummies indicate that they are at least one hundred and fifty years old, antedating the discovery of the islands by the Russians. One of the bodies in a sitting posture was encased in a rude casket of raw-hide, lashed in a netting of sinews, all parts in an excellent state of preservation. Another body is without covering. Of these valuable ethnological specimens, three have been presented to other establishments, viz, the Peabody Ethnological Museum, Cambridge, Mass.; Yale College, New Haven, Conn., and the American Museum, New York City.

Col. William F. Arny has supplied a series of dresses and utensils of the Navajo Indians, and Maj. J. W. Powell an extensive series of similar objects from the Shoshone, the Bannock, and other tribes. Mr. James G. Swan, in the course of a special exploration for the Centennial, has furnished a vast number of interesting ethnological objects from Sitka, Queen Charlotte's Islands, British Columbia, and Puget Sound.

Mr. Stephen Powers visited Nevada and California, with the special object of obtaining collections for the Centennial, the results of which are of very great magnitude. A very valuable collection of pre-historic implements from New England was obtained from Mr. J. H. Clark, of New York, and a great number of contributions of a similar character, in small numbers, have been received, for which reference must be made to the appended list. From points outside of the United States the most important contribution is that of objects of stone and earthen ware, gathered by the late George Latimer in the island of Porto Rico, where, for many years a resident, he devoted himself to bringing together everything of antiquarian interest. This gentleman died in Paris in November, 1874, and bequeathed this collection to the Smith-

sonian Institution, and it was received in April last, and is, by far, the most complete series of the kind in existence, embracing as it does a number of peculiar forms, scarcely known elsewhere.

Mr. Hugo Finck, of Cordova, has furnished some very ancient American antiquities, and corresponding objects from Salvador have been supplied by Dr. Flint. Professor Gabb has contributed an extremely exhaustive and important collection of articles from Costa Rica, leaving but little to be desired in the line of ethnology from that country. Mr. Steinberg has sent some interesting specimens, models of boats, &c., from the Samoan Islands. Mr. J. B. Norton contributed a collection of antiquities from Peru, including quite a number of interesting articles in bronze.

From the University of Christiania has been received a very interesting group consisting of a life-size figure of a Laplander in his native costume seated in a sledge attached to a mounted reindeer, the whole forming an interesting ethnological illustration of the art of locomotion in Scandinavia.

The additions to the department of mineralogy have also been very great, and will be found detailed in the accompanying list.

The number of miscellaneous collections received during the year, covering more than one department of natural history, has been very great. These have been principally from Government expeditions, the collections of which were deposited with the Smithsonian Institution, in compliance with the law of Congress constituting it the custodian of the National Museum. Among the more important of these, we may mention the collections made by the party of Lieut. George M. Wheeler in the West, embracing a large variety of objects, including many skins of mammals, birds, eggs, reptiles, insects, &c. The collections of Major Powell, although principally ethnological, and referred to under that head, also embraced numerous animals and other objects.

In the report for 1874, reference was made to the preparations by the United States for the Transit of Venus expedition and the arrangements of the Institution to secure interesting objects of ethnology and natural history; and I am happy to say that the results have been far beyond all reasonable expectations. The most valuable collection of the kind was that made by Dr. J. G. Kidder, assistant surgeon on board the Swatara, and who, on the arrival of the vessel at Kerguelen Island, remained with the astronomical party, and devoted his energies to the investigation of the natural history of that little-known land. His collections made there embrace large numbers of birds, eggs, some mammals, and marine invertebrates and plants. A report on the results of his labors occupies two numbers of the lately commenced Bulletin of the United States National Museum. Dr. Kershner, the surgeon of the Swatara, also made large contributions somewhat similar in their general character to those of Dr. Kidder, and embracing species collected at ports that were visited by the vessel.

The collections made by Mr. Russell, one of the photographers of the expedition, at Hobart Town and vicinity, were also very important, and included some specimens obtained from the Colonial Museum for transmission to the Smithsonian Institution.

From Mr. Edwin Smith, of the United States Coast Survey, in charge of the party on Chatham Island, have been received some interesting crania of the Maori and Moriori tribes.

As in previous years, the operations of the United States Fish Commission, under my charge, have furnished a rich yield of additions to the National Museum. Its headquarters for the season were established at Wood's Hole, Massachusetts, the same station as that of 1871; and the improved facilities for collecting were made use of to secure large numbers of marine animals, embracing a stock for distribution as duplicates to other establishments.

Work done in connection with the National Museum.—As might be expected, the increased number of contributions during the year has involved a corresponding amount of labor in the way of unpacking, recording, and general fitting for permanent preservation, taxing severely the efforts of the regular force and that enlisted temporarily for the purpose of meeting the exigencies of the Centennial Exhibition.

The actual number of entries made in the record-books of the Institution during the year was 12,578, carrying the total forward to 210,327.

A large amount of labor has been performed also upon the general collections. The reptiles and fishes have been put in excellent order by a transfer to suitable bottles, labeling and recording. The mammals and the skins of more or less birds have been re-arranged in new cases, and are now in excellent condition. The entire collection of duplicate birds' eggs has been overhauled, and a number of sets selected for distribution to scientific establishments.

The taxidermists have been diligently at work and have more than doubled the number of mounted animals of the collection, and greatly increased that of the birds. The work of preparing plaster-casts of fishes, reptiles, and cretaceans has also been continued, and this section is now believed to be entirely unique.

Outside of the building, as usual, much has been done on the Smithsonian collections. Dr. James Lewis, of Mohawk, N. Y., has continued his labors upon the fresh-water and land shells of the United States belonging to the Institution, having labeled the reserve series of *Unionidæ*, &c., and returned them to the Institution, the duplicates in large part being made up into sets for distribution.

Mr. J. A. Allen has had several groups of American mammals, especially the squirrels and the rabbits, from the Institution for the preparation of a series of monographs. Dr. Elliot Coues has continued his labors upon the collection of mice, and has also monographed the American carnivora.

A large number of specimens of insects has been turned over to the

Museum of the Agricultural Department, in accordance with the arrangement to render that establishment the depository of such objects; while to the Army Medical Museum many hundreds of human crania have been transmitted under a similar understanding. Several specialists, in addition to those mentioned, have received material for their investigation."

Tucson Meteorite.—Among the objects of special interest in the National Museum is a very large meteorite from Arizona, of which an account has been given in previous reports. For the possession of this specimen the Institution is principally indebted to Dr. B. J. D. Irwin, surgeon of the United States Army, who, although it had been seen by other travelers, was the first to conceive the idea of having it transferred to the Smithsonian Institution. In carrying out this proposition he was assisted by the generous co-operation of several persons and transportation companies. Owing to an imperfect history in regard to obtaining this interesting specimen, a label was affixed to it of which complaint was made by Dr. Irwin. After a review of all the facts of the case, and in accordance with his suggestion, the specimen is now labeled as follows: "The Tucson Meteorite presented to the Smithsonian Institution by Dr. B. J. D. Irwin, U. S. A., and transported from Tucson, Ariz., to Washington free of cost by S. Ainsa, the Flint & Halliday steamers, the Pacific Mail Steamship Company, and the Panama Railroad Company."

We hope this inscription will be satisfactory to Dr. Irwin and do justice to all concerned in furnishing the National Museum with one of its most interesting specimens.

GOVERNMENT EXPLORATIONS AND SURVEYS.

The following is a brief account of the principal explorations of the Government in 1875, from which specimens will be derived for increasing the collections of the National Museum.

The United States Geological and Geographical Survey, under the direction of Professor Hayden, during the season of 1875, continued its work of the two previous seasons in Colorado, completing the southern and southwestern portions, including a belt fifteen miles in width, of Northern New Mexico and Eastern Utah. The entire force of the survey was divided into seven parties for special duty, four of which were assigned to specific areas for the performance of topographical and geological work, one party attended to the primary triangulation, a second collected photographic views of the most interesting scenery and ancient ruins, while a third transported the supplies to the various districts.

The entire area surveyed during the summer of 1875 embraced about thirty thousand square miles. There now remains only the northwest corner of Colorado to be examined, prior to the completion of six sheets of the physical atlas which has been designed by the Depart-

ment of the Interior. These maps will be engraved on a scale of four miles to one inch, and each sheet will embrace an area of about eleven thousand five hundred square miles. The districts explored during the past year were not so mountainous as those of the previous year, but were located in the most inaccessible regions of this continent. Much of the country is drained by the Colorado River and is mainly a plateau country, cut in every direction by deep gorges or cañons, the sides of which show, for geological investigations, admirable sections of the strata forming the earth's crust. The topography was elaborated in great detail by the use of the plane-table. The geological structure of the country was carefully studied and much material secured that will throw light on the various problems which have perplexed geologists for years past.

The exploration of the remarkable prehistoric ruins of Southern Colorado, glimpses of which were obtained the preceding season, was continued with great success. They were traced down the cañons of the Colorado River in New Mexico, Utah, and Arizona, and their connection established with the cliff cities of the Moquis of the latter Territory. Hundreds of cliff or cave dwellings of curious architecture and many miles from water were found in the sides of the gorges, and the ruins of extensive towns discovered in the adjacent plains, indicating the former existence of a people far more numerous and advanced in the arts of civilization than their supposed descendants of the present day. A good collection of pottery, stone implements, the latter including arrow-heads, axes, and ear ornaments, &c., some pieces of rope, fragments of matting, water-jars, corn and beans, and other articles were exhumed from the *débris* of these dwellings. Many graves were found, and a number of skulls and skeletons, that may fairly be attributed to the prehistoric inhabitants, were added to the collection. Of these ruins, many interesting sketches, plans, and photographs were made, and the materials were secured for an exhaustive report on this subject, which will be given to the public at an early day.

The photographer of the survey also obtained a series of mountain views on plates 24 inches long by 20 wide, or larger by several inches than any landscape photograph ever before taken in this country.

The publications of the survey during the year 1875 consist of "The Vertebrata of the Cretaceous Formations of the West," by E. D. Cope, 303 pages text, quarto, with 57 plates; third edition of "Lists of Elevations West of the Mississippi," much enlarged; second edition of "Catalogue of Photographs;" and "Bulletin of the Survey," in six numbers, comprising 500 closely printed octavo pages, with 26 plates of sections, maps, &c.

The work of the Second Division of the United States Geological and Geographical Survey of the Territories under the direction of Prof. J. W. Powell, had arrived at the beginning of the year 1875 at a stage at which it was deemed best that a review of the geology should be made

for the purpose of establishing with greater accuracy the natural series of geological formations. A small party was organized for this purpose, and was led by Professor Powell himself. The main party under Prof. A. H. Thompson, geographer of the division, continued the work during the past season in the Territory of Utah, over an area of nearly ten thousand square miles, stretching from the Henry Mountains, on the north, to the Kai-par-o-wits Plateau on the south, and from the Colorado River, on the east, to the Aquarius Plateau, on the west.

It was found that of the lands surveyed the past season, one-fourth of 1 per cent. can be utilized by irrigation; about 50 per cent. are pasture-lands; about 9 per cent. are of timber; 4 per cent. mineral-lands; and the remainder desert.

Mr. G. K. Gilbert studied the structural geology of the country, and collected the materials for a geological map.

A second and closely allied subject of study has been the eruptions that produced the Henry Mountains, a third has been the erosion by which the structure has been laid bare, and a fourth, the Salina Creek unconformity. The investigation at Salina Creek was of a special nature, and its bearings cannot be briefly stated. Its results establish a single point of geological history, namely, that an epoch of mountain-growth, of which evidences are found in the Sevier and Sanpete Valleys, and in the Pahvan Mountains, occurred at about the end of the Cretaceous period.

The stratified rocks examined range in age from Carboniferous to Tertiary. Upon the geological map the combined Trias and Jura will cover half the space. The volcanic area will come next in size, and after that the Cretaceous. The excellence of the topographic work will enable a very thorough delineation of their boundaries.

Fossils were found in numerous localities, but no large collections were made.

Coal of cretaceous age was seen, but no other valuable minerals.

Captain C. E. Dutton was engaged in the examination of a large tract consisting of igneous rocks. It lies in Southern Utah, its northern boundary being about one hundred and fifty miles south of Salt Lake City, extending thence southward about eighty-five miles, and having a breadth of about sixty miles. It consists of a series of long, narrow tables with intervening valleys, and is structurally a repetition of those features described by Professor Powell as characteristic of the whole of Southern Utah and Northern Arizona, and which have led him to call it the Plateau Province. The tables are cut from the platforms of the valleys by immense faults and uplifted from 2,000 to 5,500 feet above the valley-plains, presenting nearly vertical walls, fringed at their base by rugged foot-hills. The plateaus are composed of thick beds of igneous rocks well stratified and nearly horizontal; the foot-hills, on the contrary, are composed of beds much broken and disturbed and intermixed with lava. The southern portions are overlaid by a conglomerate which

commences near the middle of the region, with a thickness of at least 2,300 feet, and diminishes southward to 700 or 800 feet. It is composed wholly of igneous fragments often of great size, inclosed in a matrix of sand and clay. In the southern portion it is underlaid by red sandstone and white marl of Tertiary Age; in the middle portion, by rocks of the porphyritic class. The northern and higher portion consists of well stratified rocks, having the mineral characteristics in some places of trachyte, in others of rhyolite, but with a structural habit, a texture and general mode of occurrence very unusual in that kind of rock. Lava-beds occur abundantly, but, so far as observed, are restricted to the foot-hills and valleys, and have evidently originated from the vicinity of the great faults.

Captain Dutton is also engaged in the investigation of the microstructure of the rocks of that region, and has made considerable progress in the preparation of specimens for microscopic examination.

Prof. C. A. White, paleontologist of the division, visited many points in Northern Utah, a few in Northwestern Colorado, and a few in Southern Wyoming, making a re-examination of the sedimentary beds of that region, and the evidences upon which they had been previously separated into groups. Many localities where fossils had been obtained in previous years were visited, and other localities were discovered. The collections made were from the upper portions of the Carboniferous series through the whole series to near the summit of the Tertiary. The collections were chiefly of invertebrate fossils and are very full and satisfactory. Many new species, and also several types hitherto unknown in American strata, have been obtained. It is an interesting fact, also, that while the change from a salt or brackish water condition of the earlier Tertiary deposits to a wholly fresh-water condition took place without producing any perceptible physical change in the character of the strata, the species, mostly molluscan, were more numerous, and the differentiation of types much greater during the prevalence of salt in the water than at any subsequent time after the waters became wholly fresh. Indeed, in all the purely fresh-water strata of the Tertiary groups the species and genera are few, and there is a remarkable uniformity of type throughout. Both branchiferous and pulmonate mollusks range through all the Tertiary strata, except that thus far none of the latter have been found associated with brackish-water forms. The Green River group has furnished several species of insects. Of vertebrate remains, some massive fragments of bones of a very large saurian, found in Jurassic strata five miles west of Vermilion Cañon, are worthy of remark. Scales and detached bones of teleost fishes were found in considerable abundance in dark shales at the very base of the Cretaceous groups at Vermilion Cañon, and also at various other points at the same horizon. Teleost fish remains, mostly very perfect, were obtained from the Green River group, and also some from other Tertiary strata. Throughout the whole Tertiary series more or less verte-

brate remains have been found, but it is the Bridger group that has furnished the greatest profusion of mammalian, beside many reptilian and a few ganoid remains.

Part of a skeleton of a Passerine bird has been obtained from the Green River group.

Large collections of plants have been made at numerous localities. Besides samples of silicified exogenous wood from numerous horizons throughout the Mesozoic and Tertiary series, leaves, stems, &c., have been collected from the Upper Cretaceous and Tertiary strata. These are mostly exogenous, but both ferns and palms were found associated with them in the Upper Green River group at Alkali Stage Station, twenty miles northward from Green River City.

Professor Thompson's party discovered the ruins of many prehistoric dwellings similar to those found in former years, and their position will be indicated on the ethnographic map. They also discovered on the cañon-walls and escarpments of the country many Shi'-nu-mo etchings, which were copied to scale. They will make a valuable addition to the collections of former years.

While on his travels, Professor Powell met with certain tribes of Shoshoni Indians whose arts were unrepresented in the National Museum, and the opportunity was seized to make collections of their implements and clothing, &c. In all departments, except that of food-plants, these Indians are now as fully represented as the Utes, Pai Utes, and Shi'-nu-mos by his former collections. Some additions were made to his Shoshoni vocabulary and to his mythologic tales.

During the past years of the survey, vocabularies have been collected of all of the above languages and dialects with the exception of the Ko-man'-tsu. These are far from being complete, but contain many hundred words each, some of them two or three thousand each.

The grammatic structure of these languages has also been studied to some extent, and while no structural principles have been found which have not been discovered in other Indian languages, much of value has been obtained.

Mr. L. F. Ward was attached to the division as botanist, and made very large collections from a region but hitherto little studied. He also collected a large suite of wood sections of the various shrubs and trees found in that region.

Mr. J. K. Hillers, the photographer, made a series of negatives, 101 in number, for topographic and geological purposes, and a series of 10 for ethnographic purposes.

The operations of the geographical surveys west of the one hundredth meridian, First Lieut. George M. Wheeler in charge, for the season of 1875 were confined to areas in Colorado, New Mexico, California, and Arizona, and were prosecuted in pursuance of aspecial project approved by the Chief of Engineers and the honorable Secretary of War.

The working force for the season was organized as follows: (1.) The

California section, under the command of Lieut. George M. Wheeler, Corps of Engineers; (2.) The Colorado section, under the command of Lieut. William L. Marshall, Corps of Engineers; and (3) the office-force in Washington, temporarily in charge of George M. Lockwood, assistant.

The two sections were constituted with a view to a systematic prosecution of the geodetic and allied work, and the office force was kept continuously employed upon the reductions of observations. From the California section a special party under Lieut. Eric Bergland, Corps of Engineers, was detached to make certain preliminary examinations and surveys as to the practicability of diverting the Colorado River. These labors have been accomplished so far as the past field-season would permit, and Lieutenant Bergland is now engaged in the preparation of his report. When received, with the maps and sketches, it will be forwarded, with additional information bearing upon the general subject of irrigation.

Four other parties from the California section were busily employed during the working summer months; one, under Lieut. Rogers Birnie, jr., moving to the south and east of the lower or southern limit of the Sierra Nevadas; another, under Lieut. C. W. Whipple, Ordnance Corps; and a special party under Dr. H. C. Yarrow for a brief period in the vicinity of Santa Barbara, Cal. The command of the latter party was afterward transferred to Dr. J. T. Rothrock, U. S. A., and was finally merged with the main party commanded by the officer in charge.

The results accomplished were of a highly satisfactory character, and the improvements introduced noted the transfer to a completely connected geodetic survey. Connection was had with the base-line measured by Captain, now Brig. Gen. E. O. C. Ord, near Los Angeles, Cal., in 1854. The developed base and measured triangles in a triple tier were carried eastward approximately as far as the one hundred and twentieth meridian of longitude. For the first time the correct latitude and longitude of what is probably the highest measured peak in the United States in the southern Sierras were obtained. The preliminary reductions show an altitude of 14,900 feet.

The Colorado section was composed of three principal parties: one under its commanding officer; the second under Lieut. W. L. Carpenter, Ninth Infantry; and the third in charge of Lieut C. C. Morrison, Sixth Cavalry. Their operations were in continuation of the organized work begun by the establishment of a series of main astronomical points along the east base of the Rocky Mountains, and the development therefrom of a series of measured bases and triangles so as to envelop completely the area entered and occupied, and which finally was to be connected through from the plains to the Pacific. Their labors were conducted with skill, energy, and success.

The office-force, engaged in computations, map-drawing, and other reductions, have succeeded in completing three additional atlas-sheets on a scale one inch to eight miles, and are advancing toward completion the work of five others.

The condition of the work up to June 30, 1875, appears more fully set forth in the annual report of Lieutenant Wheeler, submitted to the Chief of Engineers.

A portion of the field-force is now busily employed in the preparation of the final results at the office of the survey in Washington.

CONCLUSION.

From the foregoing statements I trust it will be evident to all interested in the prosperity of the Institution that it is successfully prosecuting the plan best adapted for realizing the intentions of its founder; that its funds are in a good condition and that its reputation and usefulness since the date of the last report have suffered no diminution.

Respectfully submitted.

JOSEPH HENRY,
Secretary Smithsonian Institution.

WASHINGTON, *January*, 1876.

REPORT OF PROFESSOR HENRY, SECRETARY OF THE SMITHSONIAN INSTITUTION, TO THE BOARD OF REGENTS, FOR THE YEAR 1876.

GENTLEMEN: I have the honor herewith to present to your board the report of the condition and operations of the Smithsonian Institution for the year 1876, it being the thirtieth report which I have been permitted to submit to your honorable body.

INTRODUCTION.

The long term of service of the principal executive officer of the Institution, and the few changes in the presiding officer of the Board of of Regents, have been attended with the important result of an uninterrupted continuity in the policy of the management of the establishment. A definite conception of the will of Smithson, and of the means best adapted to realize its intention, was clearly apprehended at the beginning, and a plan proposed and partially adopted which would carry out, in the most effectual manner, the ideas expressed in the terms of the bequest. Unfortunately Congress did not delegate to the Board of Regents the power of entirely organizing the Institution, but specified certain objects which should be included in the plan adopted. It will, however, be seen by an examination of the whole series of annual reports, that while due regard has been had to the requirements of Congress, the prominent object kept constantly in view has been the full introduction of the plan of increasing and diffusing knowledge by means of researches, publications, and exchanges. This plan, which is known as that of *active operations*, and which has received the approbation of the scientific world, was not generally understood at the time of the organization of the establishment. The value of scientific research was not as highly appreciated then as at the present day, and therefore it is not surprising that Congress should devote the income of the fund principally to the formation of a library, a museum, and a gallery of art.

These objects, though important in themselves, are all of a local character, being principally confined in their influence to the city of Washington, and therefore could not realize the liberal intention of Smithson, which includes in its comprehensive scope the intellectual advancement of mankind.

Although a majority of the Board of Regents were in favor of the plan of active operations, they did not think it prudent to ask Congress at that time to reconsider the plan which it had adopted, but concluded to proceed without delay in executing the measures prescribed, while at the same time they availed themselves of the privilege granted in one

of the sections of the act of organization to partially introduce and gradually develop the plan of active operations.

In conformity with the act of Congress, a building has been erected at a cost of upwards of $500,000. A library of 70,000 volumes has been collected—principally of a class of books of the highest value, consisting of the transactions and proceedings of learned societies—with provision for its annual increase. The museum of the Government has been enlarged to more than ten times its original size, a new department having been added to it, viz, that of American Indian Ethnography, which is more extended and varied in specimens than any other ever established. A gallery of art has also been formed, which is especially rich in illustrations of industrial arts. In addition, a considerable proportion of the income of the Smithson fund has been expended on the improvement of the grounds surrounding the building. In short, every item of the original requirement of Congress has received due attention.

To effect these objects, and at the same time to develop the plan of active operations, it became necessary to increase the income of the fund, and this has been accomplished by the adoption of a system of rigid economy and by a judicious investment of the savings of the income.

The original amount of the fund of $541,379 has been increased to $714,000. Instead of forming the library by the purchase of books, it has been created principally through exchanges, while the expense of maintaining it has been obviated by depositing the books in the Library of Congress. The care of the grounds, which was a very expensive item, has been assumed by the Government, and the cost of maintaining the museum is now defrayed by an annual congressional appropriation. The Institution having thus happily been relieved from the support of these burdens, is now, at the end of the third decade of its history, in a condition to fully realize the conception of its character as originally set forth in the first annual report of the Secretary, while the success of the plan of active operations has fully vindicated the propriety of its adoption. Through its operation the Institution has advanced almost every branch of science, and has made the name of Smithson known wherever civilization exists.

It has published twenty-one quarto volumes of transactions, entitled "Smithsonian Contributions to Knowledge," twelve octavo volumes of "Miscellaneous Collections," and thirty octavo annual reports. These publications have been presented to the principal libraries of the Old and New World. It has especially advanced natural history and ethnology by the large number of specimens it has collected and distributed to foreign and domestic museums, and has been instrumental in widely diffusing a knowledge of the progress of science by its system of international exchanges between the United States and all other parts of the world. The system of "active operations," while advancing the interests of civilization generally, has been of importance to Washington

City in assisting to constitute it a centre of scientific and literary activity, and in co-operating with other institutions here established. Besides contributing to render the Library of Congress the first in the United States in the number and value of the books which it contains, it has deposited in the Department of Agriculture 30,000 specimens of plants, and many other objects connected with agriculture. It has also deposited with the Army Medical Museum a large collection of osteological specimens, and a series of skulls for the especial illustration of the craniology of the North American Continent. It has affiliated itself with the Corcoran Art Gallery, and deposited with that admirable institution the specimens of engravings received from its foreign correspondents, as well as a number of valuable pictures belonging to its collection.

From this sketch of the past and present condition of the Institution, it will, I think, be generally admitted that the trust has been faithfully administered, and that, although changes have been found necessary in the plan adopted by Congress, yet these have been only such as originated from the peculiar nature of the bequest and the difficulty, from *a priori* conceptions, of adopting the most efficient means of realizing the intentions of the donor.

The principal event of the year 1876 connected with the Institution is its display of specimens at the International Exposition in Philadelphia. It was stated in the last annual report that Congress had made an appropriation to enable the Institution to participate with the several Departments of the Government in the Centennial Exhibition. After careful consideration of the subject it was concluded that the part of the Government exhibition under the special charge of the Institution should consist of such articles as would illustrate (1) the character and operations of the Institution itself, (2) the mineral and animal resources, (3) the ethnology, and (4) the fishery industries of the United States. The responsibility of collecting and arranging these objects, as well as of representing the Institution at the Centennial Exhibition, was intrusted to Prof. S. F. Baird, assistant secretary of the Institution, who, with a corps of assistants principally engaged for the occasion, discharged the arduous duties assigned him in a highly satisfactory manner.

The part of the Government display under the auspices of the Institution has been pronounced by competent judges one of the most interesting and complete of the kind ever exhibited. The portion which illustrated the character and operations of the Institution embraced full sets of the three classes of its publications, a series of tables showing the extent and importance of the system of international exchange, and a number of large charts exhibiting the results of the system of meteorology founded by the Institution; that illustrating the mineral wealth of the country contained an extensive series of the ores of the precious and ordinary metals, with their products, the principal varieties of coal, the clays,

marbles, slates, and other building materials, the several varieties of petroleum and coal-tar, &c., &c.—in short, a most extended collection of specimens of large size showing at one view the vast mineral resources of the United States, to which was added a variety of specimens to represent the different stages of the manufactured articles derived from the mineral kingdom. The display of the animal resources of the country was also extensive and various. It embraced all the species capable of economical application and such animals as were of special interest to the naturalist. These were represented by stuffed specimens, by life-size plaster models and by photographs. The industrial application of these animals was also exhibited as well as the apparatus by which they are pursued, captured and utilized. Among the larger mammals were well mounted specimens of those most valued for food, as the different kinds of deer, including the moose, elk and caribou, the musk-ox, and the buffalo; and the fur-bearing species were represented by bears, the grizzly, brown, black, and white; by the foxes, yellow, black, cross, gray, and kit; by wolves, fur-seals, sea-lions, sables, and minks; the oil-producing animals by whales, porpoises, and other cetaceans. Another part of the animal display embraced a series of specimens of animal food preserved by being dried, smoked, salted, pickled, and canned, together with representations of the various applications of the teeth, bones, horns, and scales; and, again, of articles used for clothing, as furs, leather, &c.

The ethnological branch of the Exposition was at the joint expense of the congressional appropriation for the Indian Bureau and that for the Smithsonian Institution. Special importance was attached to this section of the Exposition, and great exertion made to render it as complete as possible. To this end, agents were temporarily employed to obtain articles to illustrate the ethnology of portions of the country hitherto imperfectly known. The success of the enterprise was commensurate with the energy expended, and a more extensive and varied collection of articles was obtained to illustrate the past and present condition of the various native tribes of the American continent than was ever before exhibited. It consisted of a large number of the different varieties of specimens of the stone age from all parts of the continent and the West Indies, and a series of articles in use at the present time among the Indians, especially among tribes which have had but little connection with the white race. There were also exhibited numerous life-size figures to show every variety of Indian costume and personal decoration. Independent of the temporary interest which was subserved by this exhibition, the large collection of new articles has rendered an important service to the ethnology of the country, since these articles will be preserved for scientific study in the National Museum.

In addition to the foregoing, representatives, in plaster, papier-maché, and photography, of all the edible fishes of our coast were exhibited, in connection with the Smithsonian display, by the United States Fish

Commission, of which Professor Baird is the head. But for a full account of the part of the Centennial Exhibition known as the Government, or United States, exhibition, I must refer to the reports of Professor Baird in the appendix to my last and that of my present report.

The anticipations expressed in the last report in regard to the additions which would be made to the National Museum through the agency of the Centennial Exhibition have been fully realized. These additions consist of new specimens procured by the direct agency of the Institution, particularly for the exhibition; of donations from various States of the Union, from individuals, and especially from foreign exhibitors. These will require more than three times as much space for their display as was required by the previous collections of the Museum. To preserve and exhibit this increase, or to render it available for educational and scientific purposes, an additional building is imperatively demanded. The appropriation for erecting this building must be furnished by Congress, since the idea cannot for a moment be entertained of making it from the Smithson fund. Furthermore, the building should be an extension, as it were, of the present Smithsonian edifice, since if the National Museum is entirely transferred to another building the Institution would have left upon it, for support, a building erected from the income of the Smithson fund almost entirely for the accommodation of the Government collections and far too large and expensive for its own use. I beg leave, therefore, to repeat the suggestion made in my last report, that the Government be asked to take entire possession of the present edifice for the use of the Museum, to enlarge it so as to meet the present emergency, and to repay to the Institution at least a part of its cost; a portion of the sum thus repaid to be applied to providing other accommodations for the Institution in a building better adapted to its operations, and far less expensive in its maintenance; and the remainder to be added to the permanent fund for the increase of the power and efficiency of the establishment.

I may further be allowed to remark that the experience of the last year has strengthened my opinion as to the propriety of a separation of the Institution from the National Museum. The events of this period have proved that the Museum is destined to become an extensive establishment involving a large annual expenditure for its support and a variety of complex operations having no necessary connection with the plan adopted by the Institution for the "increase and diffusion of knowledge among men." Smithson gave *his own* name to the establishment which he founded, thereby indicating that he intended it as a monument to his memory, and in strict regard to this item of his will the endowment of his bequest should be administered *separate from all other funds*, and the *results achieved by it should be accredited to his name alone.* The Institution should not, therefore, be merged in an establishment of

the Government, but should stand alone, free to the unobstructed observation of the whole world, and keep in perpetual remembrance the name of its generous founder. The functions of the Museum and of the Institution are entirely different. The object of the former is the establishment of a collection of specimens of nature and of art which shall exhibit the natural resources and industry of the country, or present at one view the materials essential to a condition of high civilization which exists in the different States of the American Union; to show the various processes of manufacture which have been adopted by us, as well as those used in other countries; in short, to form a great educational establishment, by means of which the inhabitants of our own country as well as those of foreign lands who visit our shores may be informed as to the means which exist in the United States for the enjoyment of human life in the present and their improvement in the future. The Smithsonian Institution, on the other hand, does not offer the results of its operations to the physical eye, but presents them to the mind in the form of new discoveries, derived from new investigations and an extended exchange of new ideas with all parts of the world.

It is the design of the Museum to continually increase its collection of material objects; of the Institution, to extend the bounds of human knowledge. The latter collects nothing for preservation of a material character. It is true it sends out explorers and makes large collections, but these are for distribution to museums, colleges and academies, or to all establishments in which they can be useful in the way of the extension of science or the advancement of education. Every civilized government of the world has its museum which it supports with a liberality commensurate with its intelligence and financial ability, while there is but *one Smithsonian Institution*—that is, an establishment having expressly for its object "the increase and diffusion of knowledge among men." The conception of such an institution—not a local establishment intended to improve the intellectual condition of any single city or any single nation, but that of mankind in general—was worthy of the mind of Smithson, and the intelligence and integrity of the United States are both involved in the proper administration of the trust, since the terms in which it was conveyed must be truly interpreted and the intention expressed rigidly carried out.

It has been supposed that the Institution has derived much benefit from its connection with the Museum in the way of adding to its popularity, but it should be recollected that the Institution is not a popular establishment and that it does not depend for its support upon public patronage, but that it is an establishment founded on the bequest of an *individual*, and that the very nature of its operations, involving study and investigation, is in a considerable degree incompatible with continued interruption from large numbers of visitors. So far from the Institution having derived advantage from the connection which has existed between it and the Museum, the latter has proved a serious ob-

stacle in the way of the full development of the plan of the former in having absorbed, in the erection of the building and in the appropriations for the care of the specimens, at least one-half of the whole income of the Smithson fund. Furthermore, the Museum and also the Institution have now arrived at such a state of development that the two can scarcely be continued under one organization.

But the most objectionable result of the present connection of the two establishments is the necessity of the Institution appealing to Congress annually for appropriations for the support of the Museum, whereby, in the language of my last report, the Institution is presented to the world as a suppliant for perpetual aid, whereas, for carrying out the legitimate objects of the bequest, no annual appropriation is necessary from the public Treasury; for, although more than one-half of the whole income of the Smithson bequest has been devoted to a Museum and other local objects, it has succeeded, through its researches, publications, and exchanges, in establishing a reputation as extensive as civilization itself.

In this connection it may be stated that an important step has been made at the present session of Congress toward recognizing the National Museum as a separate establishment. In the language of the Act making appropriation for deficiencies, it is for the first time announced as an "appropriation for the National Museum in charge of the Smithsonian Institution."

Since the meeting of the board on the 24th instant, I have transmitted to the Senate and House of Representatives the resolutions adopted by the Regents relative to the necessity for the erection of an additional building in connection with the Institution, and have conferred with several members of Congress as to the probability of obtaining an appropriation for this purpose. These have given encouragement as to the probable appropriation of $250,000 for the erection of the proposed building,* but do not think that the proposition to purchase the Smithsonian building would at this time, on account of the condition of the Government finances, meet with favorable consideration. The proposition should, however, be kept before the public, and in due time, I doubt not, it will be adopted.

General M. C. Meigs, Quartermaster-General, United States Army, who had charge of the extension of the United States Capitol, and has had much experience in the construction of public buildings, has gratuitously furnished a plan for a new building for the Museum, and in addition generously offers his assistance in superintending its construction. This building will be of durable though inexpensive material, and expressly adapted to the uses for which it is designed. In its con-

*The bill making an appropriation of $250,000 for the erection of the building passed the Senate without opposition, but failed to receive consideration in the House because a favorable vote of two-thirds of the members present was required to bring it before that body.

struction care will be exercised not to sacrifice utility to architectural effect, but the fact will be kept in view that architecture is essentially a useful art, and that the mind receives pleasure and improvement from the contemplation of perfect adaptability no less than from imposing exterior effect.

The operations of the Institution during the past year, independent of those connected with the Centennial, have been carried on with unabated energy.

FINANCES.

I am happy to inform the Regents that the finances of the Institution are still in a favorable condition and that from the First National Bank has been received the last instalment of the money which was on deposit at the time of its suspension. The Institution has therefore lost nothing on this account, except the interest of the money which might have accrued from its investment.

The following is a statement of the condition of the fund at the beginning of the year 1877:

The amount originally received as the bequest of James Smithson, of England, deposited in the Treasury of the United States in accordance with the act of Congress of August 10, 1846	$515,169 00
The residuary legacy of Smithson, received in 1865, deposited in the Treasury of the United States, in accordance with the act of Congress of February 8, 1867	26,210 63
Total bequest of Smithson	541,379 63
Amount deposited in the Treasury of the United States, as authorized by act of Congress of February 8, 1867, derived from savings of income and increase in value of investments	108,620 37
Amount received as the bequest of James Hamilton, of Carlisle, Pa., February 24, 1874	1,000 00
Total permanent Smithson fund in the Treasury of the United States, bearing interest at 6 per cent., payable semi-annually in gold	651,000 00
In addition to the above, there remains of the extra fund from savings, &c., in Virginia bonds and certificates, viz: consolidated bonds, $58,700; deferred certificates, $29,375.07; fractional certificate, $50.13; total, $88,125.20, now valued at	42,000 00
Cash balance in United States Treasury at the beginning of the year 1877 for current expenses	21,029 18
Total Smithson funds January 11, 1877*	$714,029 18

* The date at which the settlement of the accounts for 1876 was made.

(For a detailed account of the expenditures, &c., see report of executive committee.)

From this it appears that the total fund, including the Virginia stock at its present value and the cash on hand at the end of the year, amounts to $714,029.18. The receipts during the year 1876 were $47,486.21, and the expenditures $46,978.21, leaving a balance of $508 to be added to the balance on hand at the beginning of 1876. The interest on the Hamilton bequest has been received to December 31, 1876, and, in accordance with the terms of the will, an appropriation was made from it for an archæological exploration in bone-caverns in the vicinity of Carlisle, Pa., the former residence of Mr. Hamilton. The final results will be given to the world accredited to James Hamilton, and in this way his name will be perpetuated with that of Smithson, and his donation serve as an example to be followed by others who may desire to benefit the world and live in the history of science long after their departure from this life.

The interest on the Virginia bonds received during the year was $2,907.75. The marketable value of this investment remains about the same as it was at the date of the last report.

A fact which has been omitted through inadvertence in previous reports should here be mentioned, that the Institution is greatly indebted to our highly esteemed fellow-citizen, W. W. Corcoran, esq., for valuable suggestions in its early financial history; and especially for the transferring to the Regents, at par, instead of at the market value, of $240,000 of United States bonds as a safe investment of the amount of accumulated interest devoted to the erection of the building.

PUBLICATIONS.

Since the reports of the Institution are separately distributed to many persons who have not ready access to the whole series, it is necessary in each succeeding one to repeat certain facts which may serve to give an idea of the general organization of the establishment. The following statement is therefore repeated:

The publications of the Institution are of three classes, viz, the CONTRIBUTIONS TO KNOWLEDGE, the MISCELLANEOUS COLLECTIONS, and the ANNUAL REPORTS. The first consists of memoirs containing positive additions to science resting on original research, and which are generally the result of investigations to which the Institution has, in some way, rendered assistance. The Miscellaneous Collections are composed of works intended to facilitate the study of various branches of natural history, meteorology, &c., and are principally designed to induce individuals to engage in these studies as specialties. The Annual Reports, besides an account of the operations, expenditures, and condition of the Institution, contain translations from works not generally accessible to American students, reports of lectures, extracts from correspondence, &c.

The following are the rules which have been adopted for the distribution of the several publications of the Institution:

1st. They are presented to learned societies of the first class which in return give complete series of their publications to the Institution.

2d. To libraries of the first class which give in exchange their catalogues and other publications, or an equivalent from their duplicate volumes.

3d. To colleges of the first class which furnish catalogues of their libraries and of their students, and all other publications relative to their organization and history.

4th. To States and Territories, provided they give in return copies of all documents published under their authority.

5th. To public libraries in this country, containing 15,000 volumes, especially if no other copies are given in the same place; and to smaller libraries where a large district would be otherwise unsupplied.

6th. To institutions devoted exclusively to the promotion of particular branches of knowledge are given such Smithsonian publications as relate to their respective objects.

7th. The Annual Reports are presented to the meteorological observers, to contributors of valuable material to the library or collections, and to persons engaged in special scientific research.

The distribution of the publications of the Institution is a matter which requires much care and judicious selection, the great object being to make known to the world the truths which may result from the expenditure of the Smithson fund. For this purpose the principal class of publications, namely, the Contributions, must be so distributed as to be accessible to the greatest number of readers, and this will evidently be to large central libraries.

The volumes of Contributions are presented on the express condition that, while they are carefully preserved, they shall be accessible at all times to students and others who may desire to consult them, and be returned to the Institution in case the establishments to which they are presented at any time cease to exist. These works, it must be recollected, are not of a popular character, but require profound study to fully understand them; they are, however, of importance to the professional teacher and the popular expounder of science. They contain materials from which general treatises on special subjects may be elaborated.

The publications of the Institution during the past year are mainly those described in previous reports and which have been in process of preparation for a series of years. They form two volumes of the Smithsonian Contributions to Knowledge, XX and XXI, made up of separate papers.

The *twentieth* volume of the Smithsonian Contributions to Knowledge consists of one memoir only, entitled, The Winds of the Globe, or

the Laws of Atmospheric Circulation over the Surface of the Earth; by James Henry Coffin, LL.D., Professor of Mathematics and Astronomy in Lafayette College, Pennsylvania. The tables of this volume were completed after the author's decease, and the maps drawn by Selden Jennings Coffin, professor of mathematics in the same institution. There is added to the work a discussion and analysis of the tables and charts, by Dr. Alexander Woeikof, late secretary of the meteorological committee of the Imperial Geographical Society of Russia. This volume consists of 781 quarto pages, 2 wood-cuts, and 26 plates or charts. We consider it, perhaps, the most important contribution to knowledge which the Institution has given to the world. It presents a rich mine of information for the use of the meteorologist, the physical geographer, and the mariner, thus combining materials of abstract scientific interest with knowledge immediately applicable to the practical affairs of life.

The *twenty-first* volume of Contributions to Knowledge consists of the following articles, viz:

1. Statement and Exposition of Certain Harmonies of the Solar System. By Stephen Alexander, LL. D., Professor of Astronomy in the College of New Jersey. 104 pages, 20 wood-cuts.

2. On the General Integrals of Planetary Motion. By Simon Newcomb, Professor of Mathematics, United States Navy. 40 pages.

3. The Haidah Indians of Queen Charlotte's Island, British Columbia; with a brief description of their carvings, tattoo designs, &c. By James G. Swan, Port Townsend, Washington Territory. 22 pages, 7 plates.

4. Tables, Distribution, and Variations of the Atmospheric Temperature in the United States, and some adjacent parts of America. Collected by the Smithsonian Institution, and discussed under the direction of Joseph Henry, Secretary. By Charles A. Schott, Assistant, United States Coast Survey. 360 pages, 9 diagrams, 2 plates, 3 charts. The whole volume consists of 543 pages, and 41 illustrations.

The work on Temperature, as we have stated in previous reports, consists of the results of the discussion of all the existing material which could be collected of observations of temperature in the United States, illustrated with large maps and a number of wood-cuts. It is published separately and also as a part of the series of volumes of "Contributions." The compilation of the materials and their discussion were intrusted to Mr. Charles A. Schott, of the Coast Survey, assisted by a number of computers at the expense of the Smithson fund.

In previous reports mention has been made of an extensive publication in preparation for the Institution, on the Antiquities of Tennessee, by Dr. Joseph Jones, of the medical department of the University of Louisiana, at New Orleans. Some years ago a small appropriation was made by the Institution to assist this gentleman in his exploration. He pursued his investigations with great ardor and success. In presenting an outline of his explorations he states that an effort was made to accomplish

two results: first, the accurate description of the aboriginal remains, and, second, the collection and classification of such facts as bore on their obscure history. The work when first submitted to the Institution was found to contain more historical and bibliographical matter selected from known authorities than could properly be considered contributions to existing knowledge, and it was therefore returned to the author for revision and abridgment. The omissions and modifications desired having been made, the work has been published during the past year. Some idea of its character may be obtained from the following titles of the chapters:

Burial caves.
Modes of burial practiced by the aborigines of America.
Mounds, fortifications, and earth-works.
Earth-works on the Big Harpeth River.
Earth-works on the West Harpeth and Big Harpeth Rivers.
The stone fort, and other aboriginal remains.
Relics from the mounds and stone graves.
General conclusions.

It forms a volume of 181 quarto pages with 85 wood-cuts and a very full index prepared by Prof. O. T. Mason. It will constitute a part of the twenty-second volume of the Contributions to Knowledge.

Another quarto work published during the year, and which was prepared especially for distribution at the Centennial Exposition, is that on the Archæological Collections of the United States National Museum in charge of the Smithsonian Institution, by Prof. Charles Rau. This work consists of 118 quarto pages, illustrated by 340 wood-cuts, and an account of it will be found under the head of Ethnology.

Miscellaneous collections.—In previous reports a work was described of which the first part had been published, entitled "The Constants of Nature," compiled gratuitously for the Institution by Prof. F. W. Clarke. This part was on the specific gravity, boiling and melting point and chemical formula of 2,572 distinct bodies, including over 5,000 determinations. During the past year a supplement to this part has been published consisting of the determinations of specific gravities, boiling-points and melting-points made since 1873. In it the determinations are given for nearly 700 substances, of which at least 400 are new. It is embraced in 61 octavo pages.

Part II of the same general work has also been published during the past year. It is entitled "A table of specific heats for solids and liquids," consisting of 58 octavo pages, including 410 substances.

Part III has also been printed, consisting of "Tables of expansion by heat for solids and liquids." It gives data for the expansion of about 350 different substances, no liquid mixtures or solutions, however, being included. It occupies 57 octavo pages. This work has been much called for by practical chemists and physicists. It will be continued

from time to time as the author, amid other professional engagements in the University of Cincinnati, can find leisure to select and verify the materials.

In the year 1875 another series of publications was commenced which forms a part of the Miscellaneous Collections. It is entitled "The Bulletins of the National Museum," and is intended to illustrate the collections of natural history and ethnology belonging to the United States, of which the Smithsonian Institution is the custodian. Six numbers of these Bulletins have been published. They are prepared at the request of the Institution by different individuals, and are printed by the authority of the Secretary of the Interior at the Government Printing-Office.

The following is a list of these Bulletins:

I. Check-list of North American Batrachia and Reptilia; with a systematic list of the higher groups, and an essay on geographical distribution, based on the specimens contained in the United States National Museum. By Edward D. Cope. 1875. 8vo, 108 pp.

II. Contributions to the Natural History of Kerguelen Island, made in connection with the American Transit of Venus Expedition, 1874–'75. By J. H. Kidder, M. D., U. S. N. Part I, Ornithology, edited by Dr. Elliott Coues, U. S. A. 1875. 8vo, 62 pp.

III. Part II of the foregoing, consisting of Oology, Botany, Geology, Mammals, Fish, Mollusks, Insects, Crustaceans, Annelids, Echinoderms, Anthozoa, Study of Chiornis Minor. Prepared by J. H. Kidder, E. Coues, Asa Gray, F. M. Endlich, Th. Gill, W. H. Dall, C. R. Ostensacken, H. A. Hagen, S. I. Smith, A. E. Verrill, and S. F. Clark. 1876. 8vo, 124 pp.

IV. Birds of Southwestern Mexico, collected by Francis E. Sumichrast, for the United States National Museum. Prepared by George N. Lawrence. 1876. 56 pp.

V. Catalogue of the Fishes of the Bermudas, based chiefly upon the collections of the United States National Museum. By G. Brown Goode, assistant curator United States National Museum. 1876. 8vo, 84 pp.

VI. Classification of the collection to illustrate the animal resources of the United States. A list of substances derived from the animal kingdom, with synopsis of the useful and injurious animals, and a classification of the methods of capture and utilization. By G. Brown Goode, assistant curator United States National Museum. 1876. 8vo, 140 pp.

An account of the first two of the Bulletins was given in the last annual report.

The third number of the series, that on the natural history of Kerguelen Island, by Dr. J. H. Kidder, United States Navy, embodies the result of the examination of the eggs, the identification of the plants, fishes, mollusks, insects, &c., of the region. It also contains a brief

description of the collections of Surgeon Kershner, of the United States Navy, in the Chatham and Auckland Islands, and in New Zealand, and of Mr. I. Russell in the latter place.

The botany of Kerguelen Island had previously been very thoroughly studied by Dr. J. D. Hooker in connection with Sir James Clarke Ross's Antarctic Expedition, (1839–'41.) A number of new phanerogams, ferns, sea-plants, and lichens have been added to the list.

The zoological collections, though comparatively small, contain an unusual number of new genera and species, especially among the mollusca, insects, crustacea, echinoderms, &c., descriptions of which have been furnished to Dr. Kidder by Professors Verrill, S. I. Smith, Dall, Ostensacken, and Hagen.

The Bulletin concludes with a study of *Chionis minor*, a unique and little-known bird, with an attempt to establish its proper position in classification.

Bulletin No. 4, the catalogue of birds collected by Prof. Francis Sumichrast in Southwestern Mexico, is a scientific account of the collection made in accordance with an arrangement between the Smithsonian Institution and Professor Sumichrast for an extended exploration of the Pacific side of the Isthmus of Tehuantepec for the purpose of procuring specimens of its natural history. During the past four years, four instalments of birds have been received and examined by Mr. Lawrence, containing 321 species, represented by more than 1,700 specimens, all of a remarkably fine character, and bearing testimony to Professor Sumichrast's efficiency as an industrious and energetic collector, while the character of the many valuable notes he has contributed manifest his minuteness and intelligence as an observer.

From this exploration it appears that the region of the Pacific is comparatively much poorer in birds than that of the Atlantic. This is attributed to the extreme dryness of the soil, to the scarcity of vegetation and of insect life, and to the duration of the winds from the northeast and southwest, which there prevail with great violence. The contraction of the American continent between the ninety-fourth and ninety-fifth degrees of longitude west from Greenwich, forms what is called, improperly perhaps, the Isthmus of Tehuantepec. In a physical point of view, it may be considered as divided into three parts: first, an eastern, extending from the Gulf of Mexico to the Puerta; second, a central, from the Puerta to the Chivela; and, third, a western, from the Chivela to the Pacific. The eastern part has its largest portion covered with thick and damp forests, vegetation which rivals the greatest beauties of the tropics. The central region presents an undulating surface embossed with innumerable hills which gradually unite on the western side with the mountains of the Sierras. Although watered by numerous streams, it presents but a scanty vegetation, essentially characterized by oaks on one side and palm-trees on the other. The western division, or plains of the Pacific, is very dry, and presents

a striking contrast to the rich plains on the Atlantic slope. The number of animal forms, as well as the vegetable, decreases perceptibly in proportion as we advance from the Atlantic to the Pacific. It is worthy of note that while the species belonging to the western province seldom, if ever, find their way to the eastern division, those, on the contrary, in the latter province, spread to within a short distance of the shores of the Pacific. The difference in the elevation of the ground which exerts in Mexico such a great influence over the geographical distribution of animal species, exists only in a slight degree in the Isthmus of Tehuantepec, the highest point of the territory, not being elevated more than from 500 to 2,800 feet above the level of the sea.

The fifth bulletin, a "Catalogue of the Fishes of the Bermudas," is based chiefly upon collections in the United States National Museum, made and described by G. Brown Goode.

A visit to the Bermudas during the months of February and March, 1872, afforded the author opportunities for collecting the notes and specimens upon which this paper is based. At the time of his visit only seven species of fishes had been recorded from this locality, and the only authentic information regarding the fish-fauna was contained in one short chapter of a work by John Matthew Jones, of England. In the present list, Mr. Goode enumerates seventy-five species, most of which were personally observed.

Bulletin No. 6 consists of a tabular classification prepared by Professor Goode, to facilitate the work of collecting and arranging the materials gathered by the Institution for the International Exhibition, to illustrate the resources of the United States as derived from the animal kingdom. With a view to its future use in the classification of the articles of the kind which it includes, it is presented in a permanent form as a part of the Miscellaneous Collections. It forms a pamphlet of 140 octavo pages, of which the following are the several divisions: The first group, section A, is an index of the whole series, including all North American animals which are directly beneficial or injurious to man. Section B embraces all instruments and methods employed by the hunters, trappers, and fishermen of North America, aboriginal and civilized. It is a monograph of all matters relating to the chase and fisheries of the country. Section C includes all methods of utilizing animal products. Section D presents a list of all useful substances derived from the animal kingdom, and section E all articles illustrating the culture and protection of useful animals. Though this work was hurriedly prepared for use at the Centennial Exhibition, and is necessarily incomplete, yet it will serve as a basis for other attempts of a similar character, and will be of especial use in making preparation for future International Exhibitions.

Centennial Outline Map of the United States and other portions of North America.—In order to serve as a basis for showing the larger features

of the physical geography, and to present graphically any special statistics of the United States to accompany the exhibits from the Smithsonian Institution at the International Exhibition of 1876, it was deemed desirable to have constructed an outline map on a scale sufficiently large for that purpose. The design and construction of this map were intrusted to Mr. W. L. Nicholson, topographer of the Post-Office Department, and from the drawings prepared under his care a number of prints were made by lithograph transfer. The map is on a scale of 16 miles to the inch, (1 : 1,013,760,) in 20 sheets, covering, when mounted, an area of $16\frac{3}{4}$ feet long, (horizontally,) by 15 feet wide, (vertically,) extending from the southern shores of Lake Winnepeg and Hudson's Bay to the parallel of 15° north latitude, taking in the whole of the Gulf of Mexico, Yucatan, and the larger West India Islands. From east to west it includes parts of Nova Scotia and of Vancouver Island, the Territory of Alaska being shown, on a smaller scale, detached, in a vacant corner of the map. The meridians and parallels were laid down from the polyconic-projection tables of the United States Coast Survey Office. The details are restricted to the more general topographical (and political) features—the shore-lines of the oceans and great lakes, the principal rivers, the State and international boundaries, and a few of the larger cities, the mountain-topography being omitted, as one of the desiderata for additions to such a map of this continent.

The original construction and the printing of this map were undertaken by the Smithsonian Institution, but, as an offset toward the reimbursement of this expense, propositions were made and accepted from several of the subcommissions of the United States executive departments exhibiting at Philadelphia for the purchase of a limited number of copies of the map. Under these arrangements, the Agricultural Department made use of a series of six of these maps, exhibiting by colors, in a very effective manner, statistics of the value of farm-lands, wages of farm-labor, areas of woodland, products of sugar-crops, of textile fibers, and of fruits. The Light-House Board employed one for showing the sites of and the relative orders of all the light-houses along the sea-coast, the great lakes, and the Mississippi, Missouri, and Ohio Rivers. The Post-Office Department made use of one to show the railway mail-service of the United States. Various bureaus of the Department of the Interior, including the Census, Education, and Geological Survey of the Territories, used several sets of the same.

The Smithsonian Institution exhibited four of these maps for presenting the results of the meteorological discussions of rain-fall and of temperature over the United States in the summer and winter months. These were enlargements from the maps accompanying the publications of the Smithsonian Institution. On these four maps an attempt was made, by the addition of the greater mountain chains, to give a coincident view of their relation to the great climatic elements.

A fifth set of the sheets was used for representing the geology of the United States and Territories.

There now remain on hand several sets of the original prints of this large outline map, available for purposes similiar to the foregoing, and which it is proposed to dispose of to institutions or associations willing, by a small proportionate outlay, to aid in the re-imbursement of the original expenses.

Annual report.—The annual report of the operations of the Institution for the year 1875 was presented to Congress on the 7th of April, 1876, but the extra copies ordered as usual were not delivered to the Institution until December, and their distribution has therefore only just now commenced. An edition of 10,500 copies was printed, 1,000 for the use of the Senate, 2,000 for the House of Representatives, and 7,500 for the Institution. The appendix to the report contains translations of Arago's eulogy on Volta; DeCandolle on the probable future of the human race; the annual report for 1873–'74 on the transactions of the Geneva Society of Physics and Natural History; a lecture on the past and future of geology, by Prof. Joseph Prestwich, of England; a report on the diminution of the water of rivers and streams, by a committee of the Royal Academy of Vienna; an original communication on the refraction of sound, by Wm. B. Taylor, of Washington; a letter by Professor Henry on the organization of local scientific societies, intended to furnish an answer to numerous letters addressed to the Institution on this subject; a translation of a proposed international code of symbols for charts of prehistoric archæology, by Profs. Mortillet and Chantre; an article on characteristics pertaining to ancient man in Michigan, by Henry Gillman; and a memoir on the stone-age in New Jersey, by Dr. C. C. Abbott.

RESEARCHES.

It has been stated in previous reports that an annual appropriation was made for several years to enable Professor Newcomb, of the National Observatory, to employ accountants for the reduction of the mathematical expressions of the orbits of the planets Uranus and Neptune to numerical tabular results.

Although the representation of the observations of Uranus by the tables presented to the Smithsonian Institution four years ago, was regarded by astronomers generally as highly satisfactory, it was not so considered by the author, owing to the systematic character of the minute discrepancies. He therefore desired to ascertain whether these discrepancies arose from errors in the computation of the perturbations of Uranus, and, if not, whether they could be due to the action of an ultra-Neptunian planet. The first step in the investigation was to have a complete duplicate computation of the perturbations from 1753 until the present time, by the method of mechanical quadratures, with which to compare the results computed from the tables. An appropriation

having been made by the Institution for this investigation, it has been found that there is a small discrepancy between the two sets of results, the cause of which has not yet been ascertained.

If it is found on further examination that there is really a discrepancy between the observations of Uranus and its motion as computed from the theory of gravitation, it will be considered that the chance of the discrepancy being due to an ultra-Neptunian planet is sufficient to justify the continuance of the work.

Professor Newcomb remarks that the problem now before us is vastly more difficult than that with which Le Verrier had to deal. When Le Verrier had completed the determination of the motions of Uranus, taking into account the action of Neptune, he considered the representation of the observations by theory highly satisfactory. But the outstanding differences were far larger than those with which we are now occupied.

In regard to the computations of the comet of short period mentioned in the last report, we have nothing further to report at present, the work having been suspended for a time on account of the transfer of Professor Stone from the National Observatory to the Cincinnati observatory, and the consequent absorption of his time in preparing for his new duties.

A small appropriation has also been made for a series of physiological observations on the temperature of the human body under certain abnormal conditions, by Prof. H. C. Wood, jr., and Dr. Horace Hare, of Philadelphia. These observations are in progress, and it is thought the results of the investigation will be ready for publication in the next annual report. They relate especially to the subject of animal heat, the mode of its production, and its relation to pathological and normal functions. The first question to be investigated is whether ordinary fever is due to an increased production or retention of heat. A series of analytical experiments as to the amount of carbonic acid given off by the animal during the normal and the febrile state, also the amount of excretions from the kidneys, will be made, and a determination as to whether the depression of temperature, caused by ammonia, section of the spine, injuries, &c., is due to a diminished production or increased loss of heat; also whether the paralytic fever observed in connection with certain nerve sections is always caused by such sections, whether it is induced by an increase in the production of heat, or by its retention; and finally, how the nervous system acts in the regulation of the calorific function.

METEOROLOGY.

The Institution has continued the reduction and discussion of the large amount of meteorological material which it collected during the twenty years of its system of observations. The miscellaneous work by the computers of the Institution during the year 1876, is as follows:

1. The temperature observations for the years 1871, '72, '73, have been

reduced and partly tabulated, thus closing the series conducted by the Institution relative to temperature.

2. The temperature and rain-fall observations made at a large number of stations in British North America have been tabulated to the end of the year 1874. This was a special matter undertaken to facilitate and extend the rain-fall discussion.

3. A number of averages have been computed and the work continued relative to the publication of a second edition of the memoir on the rain-fall of the United States, which will embrace additional material.

4. Meteorological information has been furnished in many instances to individuals making application therefor, they bearing the expense of the clerical labor involved in the copying.

To complete the reduction and discussion of the system of meteorology conducted by the Institution, there remain the observations relative to the pressure of the atmosphere, and also those relative to moisture, thunder-storms, and casual phenomena. These will be taken up during 1877.

TELEGRAPHIC ANNOUNCEMENT OF ASTRONOMICAL DISCOVERIES.

The arrangement which was concluded between the Smithsonian Institution and the Atlantic cable companies in 1873, by which free telegraphic transmission of astronomical discoveries was granted between Europe and America, has been continued during the past year.

The following is a list of the small planetoidal bodies discovered in 1876, the most of which discoveries were announced through this Institution:

No.	Name.	Date of discovery.	Discoverer.	Place of discovery.	Mean distance.*
158	Coronis	January 4	Knorre	Berlin	3.00
159	Emelia	January 26	Paul Henry	Paris	3.13
160	Una	February 20	Peters	Clinton	2.75
161	Athor	April 16	Watson	Ann Arbor	2.38
162	Laurentia	April 21	Pros. Henry	Paris	3.02
163	Erigone	April 26	Perrotin	Toulouse	2.35
164	Eva	July 12	Paul Henry	Paris	2.55
165	Loreley	August 9	Peters	Clinton	3.13
166	Rhodope	August 15	Peters	do	2.72
167	Urda	August 28	Peters	do	3.22
168	Sibylla	September 28	Watson	Ann Arbor	3.38
169	Zelia	September 28	Pros. Henry	Paris	2.36

A stellar outburst in the constellation of the "Swan" was observed November 24, 1876, by Dr. Schmidt, at Athens; a phenomenon similar to the remarkable stellar outburst which occurred in the "Northern Crown" in May, 1866, though not so brilliant, as it did not apparently exceed the light of a star of the third magnitude at its greatest brightness. At the close of the year it had dwindled to the lowest visible magnitude.

* The figures in the last column of the table represent the mean distances of the several bodies from the sun, that of the earth being taken as unity.

CORRESPONDENCE.

The correspondence of the Institution during the past year, especially on account of the Centennial Exhibition, was very largely increased, and has formed no inconsiderable part of the labors of the officers. The usual number of inquiries have been made as to the name and character of specimens of natural history, mineralogy, &c. The number of scientific problems received for solution has not been diminished. Several elaborate treatises have been submitted to the Institution for examination, purporting to be explanations of the theory of gravitation, and other extended generalizations of natural phenomena. As the theory of gravitation is a prominent subject of investigation by those who are interested in scientific speculations, we would direct attention to a paper, published in the appendix to this report, prepared for the Institution by Mr. William B. Taylor, of Washington, giving a history, with comments, of all the attempts which have been made since the discoveries of Newton to the present time to refer the phenomena of gravitation to some other cause than that of action at a distance. This elaborate paper will exhibit the difficulties of the problem which those who endeavor to solve it have to contend with, as well as the entire failure of all the attempts which have been made and the probable result of all that will be hereafter essayed in regard to it.

Among the subjects to which attention has been called by foreign correspondents is that of the organization of a society, under the auspices of the King of Belgium, at Brussels, for a thorough exploration of the African continent, the final object of which being the suppression of the slave-trade, the opening of the country to foreign commerce, and its advancement in civilization. To this enterprise the attention of all the geographical societies of the world is called, and their co-operation solicited. It is proposed to run lines of survey across the continent from east to west and from north to south, establishing depots at intervals for the accumulation of articles of commerce and the supply of the explorers. This is truly an enterprise worthy of the present age, since its object is to open, for the uses of civilized man, a portion of the earth richly endowed with the means of the support and the enjoyment of human life, now almost a waste, or only sparsely inhabited by barbarian tribes. It is a work to which the attention of our educated citizens of pure African descent should be directed, as opening a field of unparalleled usefulness in the way of advancing the civilization of the world, and it is one to which they are especially adapted, since, in a letter from Professor Edw. D. Blyden, of Liberia College, published in the appendix to the Smithsonian Report for 1870, it is shown that only individuals of pure African blood are fully fitted for withstanding the peculiar influence of the climate.

EXCHANGES.

The operations of this part of the general system of labor of the Institution have assumed a magnitude during the past year far greater than

that of any previous year since its first adoption. This has arisen from the fact that we have presented to foreign libraries, especially those of Australia and New Zealand, a large number of sets of the publications of the Institution, and also those of the publications of the Government entrusted to the Institution for distribution.

During the past year 4,853 packages, each containing several articles, have been received from abroad for distribution to institutions and individuals in this country.

Three hundred and twenty-three boxes, averaging 7 cubic feet each, with a total weight of 80,000 pounds, were sent abroad by the Institution during the year. The total number of separate parcels contained in these boxes was about 13,000.

As an evidence of the high estimation in which this branch of the operations of the Institution is regarded, as well as to give proper credit to the parties who have transmitted free of cost the packages of the Institution, we reprint, as usual, the following list of their names:

Cunard Steamship Company.
Anchor Steamship Company.
Pacific Mail Steamship Company.
Panama Railroad Company.
Pacific Steam Navigation Company.
New York and Mexico Steamship Company.
New York and Brazil Steamship Company.
North German Lloyd Steamship Company.
Hamburg American Packet Company.
French Transatlantic Company.
North Baltic Lloyd Steamship Company.
Inman Steamship Company.

The special thanks of the Institution are again tendered to the above-mentioned companies for their enlightened liberality.

We may also mention as an evidence of the high appreciation of the character of the Smithsonian exchanges that the packages bearing the marks of the Institution are admitted free of duty and without examination into all foreign ports.

The following are the principal foreign agencies of reception and distribution of the Smithsonian exchanges:

London, William Wesley, 28 Essex street, Strand.
Paris, G. Bossange, 16 Rue du 4 Septembre.
Leipsic, Dr. Felix Flügel, 49 Sidonien Strasse.
St. Petersburg, L. Watkins & Co., 10 Admiralty Place.
Amsterdam, Frederick Müller, Heerengracht KK. No. 130.
Milan, U. Hoepli, 591 Galeria Cristoforia.
Harlem, Professor von Baumhauer.
Christiania, Royal University of Norway.
Stockholm, Royal Swedish Academy of Sciences.
Copenhagen, Royal Danish Society.
Lisbon, Royal Academy of Sciences.
Madrid, Royal Academy of Sciences.

Havana, Dr. Felipe Poey.
Santiago, University of Chili.
Mexico, Mexican Society of Geography and Statistics.
Montreal, Geological Survey of Canada.

The packages of the Institution for the West Indies have been kindly forwarded by Mr. Thomas Bland, of New York, and those for Turkey, by Messrs. Chrysoveloni & Co., of 5 Fenwick street, Liverpool, England; and some other points in the East, by the American Board of Commissioners for Foreign Missions, Boston.

The following table exhibits the number of foreign establishments with which the Institution is at present in correspondence, or, in other words, to which it sends publications and from which it receives others in return:

Foreign institutions in correspondence with the Smithsonian Institution.

Algeria	6	Italy	181
Argentine Republic	13	Japan	4
Australia	30	Java	5
Belgium	111	Liberia	1
Bolivia	1	Mauritius	3
Brazil	9	Mexico	15
British America	27	New Zealand	15
British Guiana	3	Norway	25
Cape Colony	4	Peru	3
Central America	2	Philippine Islands	3
Chili	8	Polynesia	2
China	1	Portugal	23
Colombia	3	Russia	162
Denmark	28	Spain	18
Dutch Guiana	1	St. Helena	2
Ecuador	1	Sweden	22
Egypt	8	Switzerland	70
France	324	Syria	1
Germany	646	Turkey	11
Great Britain and Ireland	363	Venezuela	2
Greece	8	West Indies	7
Holland	65	General	7
Iceland	2		
India	29	Total	2,275

Statistics of exchanges sent during the last eight years.

	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
Number of boxes	112	121	108	179	196	131	208	323
Bulk in cubic feet	1,033	1,189	772	954	1,476	933	1,503	2,261
Weight	23,376	31,383	28,950	26,850	44,236	27,990	45,300	80,750

To facilitate the business of the exchanges, the following rules have been adopted:

1. Every package, without exception, must be enveloped in strong paper, and secured so as to bear separate transportation by express or otherwise.

2. The address of the Institution or individual, for whom the package

is intended, must be written legibly on the cover, and the name of the sender on one corner of the same.

3. No single package must exceed half of a cubic foot in bulk.

3. A detailed list of addresses of all the parcels sent, with their contents, must accompany them.

5. No letter or other communication can be allowed in the parcel, excepting such as relates exclusively to the contents of the package.

6. All packages must be delivered in Washington free of freight and other expenses.

7. Every parcel should contain a blank acknowledgment, to be signed and returned, either through the agent of the Institution, or, what is still better, through the mail, to the sender.

Should returns be desired for what is sent, the fact should be explicitly stated on the list of the contents of the package. Much disappointment is frequently expressed at the absence of any return in kind for transmissions; but unless these are specifically asked for, they will fail in many instances to be made. It will facilitate the labors of the Institution very much if the number corresponding to the several addresses in the Smithsonian printed catalogue be marked on the face of each parcel; and for this purpose a copy of the catalogue will be forwarded to all who apply for it.

Specimens of natural history will not be received for transmission unless with a previous understanding as to their character and bulk.

8. Unless all these conditions are complied with, the parcels will not be forwarded from the Institution; and, on the failure to comply with the first and second conditions, will be returned to the sender for correction.

Exchange of Government documents.—In the last report a full account was given of the system adopted for carrying out the law relative to the exchange of the official publications of United States Government for those of foreign nations. In accordance with this system, during the past year 120 boxes of documents were forwarded, the following being a list of the distribution:

International exchange of Government publications in 1876.

Sent to—	Boxes.	Sent to—	Boxes.
Queensland	7	Germany	3
Victoria	7	Saxony	5
South Australia	7	England	5
New Zealand	7	Spain	5
New South Wales	7	Turkey	1
Tasmania	7	Holland	1
Switzerland	7	Belgium	1
Sweden	7	Portugal	1
Scotland	7	Ottawa	1
Buenos Ayres	7	Ontario	1
Hayti	6	Mexico	1
Venezuela	6	Brazil	1
Norway	5	Chili	1
Prussia	5	Japan	1

The expense of boxing, packing, transporting, and paying of agents in connection with the transmission of these sets of Government documents, amounting to $857.50, was advanced by the Institution, with the expectation that it would be repaid from an appropriation for the Library of Congress; but when the account was presented we were informed that, in consequence of the reduction of the appropriations at the last session of Congress, there were no funds available for the purpose. We have, therefore, requested the Library Committee of Congress to procure the insertion of an item in the deficiency bill to re-imburse the Institution for the amount advanced, and also to defray the cost of the necessary expenses of the system of exchange for the ensuing six months.

LIBRARY.

The library of the Institution, as has been stated in previous reports, has been placed on deposit in the Library of Congress under the direction of Mr. A. R. Spofford, librarian.

The following is a statement of the books, maps and charts received by the Smithsonian Institution in 1876 and transferred to the Capitol:

Volumes:		
Octavo, or less	756	
Quarto, or larger	261	
		1,017
Parts of volumes:		
Octavo, or less	2,047	
Quarto, or larger	2,268	
		4,315
Pamphlets:		
Octavo, or less	1,530	
Quarto, or larger	348	
		1,878
Maps and charts		375
Total		7,585

The articles received at the Institution are recorded in a book prepared for that purpose and afterwards transferred to the Library of Congress. Much use is made of the books of the Institution which are in the Library of Congress as well as those of the latter library by the collaborators of the Institution.

Among the principal donations received in 1876 are the following:

From the director-general of the Royal Collections of Art and Science, Dresden: "Monumente des Mittelalters und der Renaissance aus dem sächsischen Erzgebirge, die Klosterkirche Zchillen, jetzt Wechselburg und die Rochlitzer Kunigunden-Kirche. 50 Blatt gross folio, photographische Aufnahmen und Schnellpressen Lichtdruck von Römmler & Jonas, Dresden, unter artistischer Leitung von Carl Andreae."

Dresden, 1875. "Gravirte und geätzte Ornamente von Gegenständen des k. Historischen Museums und der Kunstgewerblichen Ausstellung zu Dresden vom Jahre 1875." Parts i and ii, Dresden, 1876. Folio. "Archiv für Literaturgeschichte." Vols i, v, 1–3. Leipzig, 1870–1876, 8vo. "Mittheilungen aus dem k. Zoologischen Museum zu Dresden." Part 1, Dresden, 1875, 4to, and various pamphlets.

From the Royal Historical Academy, Madrid: Coleccion de Documentos inéditos para la Historia de España. Vols. xxi, lix. Madrid, 1852–1873, 8vo, and Historia de Felipe III. Vols. I, II, Madrid, 1875, 8vo.

From the Ambrosian Library, Milan: "Translatio Lyra Pescitto Veteris Testamenti ex Codice Ambrosiano." Vol. I, Part 1. Mediolani, 1876. Folio.

From the Austro-Hungarian War Department, Vienna: "General Karte von Bosnien, der Herzegovina, von Serbien und Montenegro." 120 sheets.

From the Icelandic Literary Society, Reykiavik, Iceland: Skirnir, 1875, Copenhagen, 8vo. Skyrslur og Reikningar, 1874–1875, Copenhagen, 1875, 8vo. Frjeltir fra Islandai, 1874. Reykiavik, 8vo. Report on the Icelandic Literary Society, Copenhagen, 1872, 8vo.

From Mr. James L. Bowes, Liverpool: Keramic Art of Japan, illustrated. Parts iii, iv. London and Liverpool, 1876. Folio.

From the British Museum, London: The Cuneiform Inscriptions of Western Asia. Vol. iv. London, 1875. Folio. Catalogue of Birds. Vol. ii. 1875, 8vo. Catalogue of Additional MSS. 1854–1860. 1875. 8vo. Catalogue of Spanish MSS. Vol. i. 1875. 8vo. Catalogue of Oriental Coins. Vol. 1. 1875. 8vo.

From the Ministry of the Interior, Topographical and Hydrographical Division, Christiania, Norway: Aarbog for Handels Marinen, 1870–1875, 11 parts, Kristiania, 8vo. Den Norske Lods, vols. i and viii, Kristiania, 1870, 1871, 8vo., and 36 charts.

From the University of Chile, Santiago: Anales, vols. xlv and xlvi, Santiago, 1873, 1874, 8vo. Twenty-one volumes of government documents, 1874, 1875, 4to.

From the Society of Natural History, Madrid, Spain: Anales, vols. i–v, Madrid, 1872–1876, 8vo.

From Dr. Otto Ule, Halle, Saxony: Die Natur, vols. xi, xii, xvii, xix–xxiii. New series, i, ii, Halle, 1862–1876, 4to.

From the Royal Academy of Science, Letters, and Arts, Modena, Italy: Memorie, vols. xiii–xvi, Modena, 1872–1875, 4to.—33 dissertations and discourses.

Die Astronomisch geodätischen Arbeiten des K. K. Militär, Geographischen Instituts in Wien. III. Vienna, 1875. 4to. General Karte von Central Asien. Blatt 1–12. Special Karte im Maastabe 1, 75,000. 22 parts.

From the Geographical Establishment, Brussels, Belgium: Nouveau

Plan Hypsométrique de Bruxelles et des Environs, 33 parts. Carte des Chemins de Fer de la Belgique, 1876. Carte des Chemins de Fer de l'Europe Centrale. Mirror d'Uranie d'apres l'Anglais d'Elton. Carte Générale de la Palestine. Atlas Universel de Geographie, composée de 20 belles cartes.

From the Observatory of the Roman College, Rome, Italy: Bulletino Meteorologico, 1863–1875, 10 vols., 4to, and 36 astronomical pamphlets.

From the Royal Swedish Academy of Sciences, Stockholm: Handlingar Ny. Folja. Vols. x–xii, 1872–1875. 4to. Bihung, vols. i–iii, 1872–1776. 8vo. Ofversigt. Vols. xxviii–xxxii, 1872–1876, and 8 parts of volumes and pamphlets.

From the Russian Government, Ministry of War, St. Petersburg: Eestniah Osadie Straasbourgah. Vols. i and ii. St. Petersburg, 1874, 1875. 8vo. Artillerysky Zhurual, 61 parts. Eengenneerie Zhurual, 29 parts. Oreyeyuyy Zboruik, 22 parts, and Voennoe Zboruik, 6 parts.

From the Hungarian Academy of Science, Buda-Pesth: Publications of the Academy, 38 vols. and 133 parts of volumes. Buda-Pesth, 1875–1876, 4to. and 8vo.

From the Board of Admiralty, London: Tide-tables for the British and Irish ports, 1876, 8vo. Remarks on Davis Straits, Baffin's Bay, &c., 1875, 8vo. Lights, 1876, 10 in number, and 32 charts published by the Hydrographic Office.

From the Royal Library, Stockholm: Government documents, 25 volumes, 1876, 4to.

From the Imperial Medico-Chirurgical Academy, St. Petersburg: 31 Inaugural dissertations for 1875.

From the Universities of Dorpat, Helsingfors, Berlin, Bonn, Buda-Pesth, Erlangen, Göttingen, Greifswald, Halle, Heidelberg, Leipzig, Marburg, Tübingen, Bern, Zürich, Louvain, and from the Royal High-School, Utrecht: Inaugural dissertations for 1875.

From the Library of Parliament, Ottawa, Canada: 21 volumes, and from the Parliament of Ontario, Toronto, 10 volumes government documents.

From the State Library of Vermont: 6 volumes documents.

From the State Library of Ohio: 10 volumes documents.

ETHNOLOGY.

The Institution during the past year has, as usual, given special attention to ethnology, and has directed investigations to be made in all cases where information has been received of the existence of mounds, shell-heaps, &c. The subject, however, has received a special impetus through the Centennial appropriation of Congress, circulars having been distributed to the correspondents of the Institution requesting aid in collecting specimens and in giving information as to the existence of particular collections. By this means and through the agency of the United States Indian Bureau a very large addition has

been made to the collection of ancient implements as well as to that of those used by Indians of the present day. It was stated in the last report that the services of Charles Rau, a well known ethnologist, had been engaged to classify and arrange the collection in the National Museum and to prepare a descriptive catalogue for publication. This work he has accomplished in connection with the Centennial Exhibition, and although the catalogue is not entirely exhaustive it will serve to show what ample material has been obtained by the Smithsonian Institution for the study of North American archæology. The following is an account of the work in question:

In the introduction the author speaks of the system adopted by him in arranging the Smithsonian collections illustrative of North American archæology and ethnology. The *archæological* series comprises objects supposed to belong to times antecedent to the European occupation, and which, therefore, are thought to exhibit aboriginal art unmodified by contact with the whites. These relics, consisting of chipped and ground stone, of copper, bone, horn, shell, clay, and, to a small extent, of wood, were found in mounds and other burial-places of early date, in caves and in the shell-heaps met with along the coasts of North America. The second, or more strictly *ethnological*, series, a description of which is not attempted in the present volume, consists of articles obtained from existing native tribes by private explorations, as well as by expeditions undertaken by order of the United States Government, and contains almost every object tending to illustrate the domestic life, hunting, fishing, game, warfare, navigation, traveling by land—in short, every phase of the existence of these tribes that can be represented by tangible tokens. The uses of these ethnological specimens are in most cases well known, a statement which cannot be made in reference to the objects constituting the archæological series, for many of the latter leave a wide scope for conjecture as to the manner in which they were employed by their makers. These doubts extend even to certain types hitherto thought to be well recognized. Thus, many of the so-called arrow and spear heads were not what their names imply, but knives used in connection with short wooden handles. Such cutting-tools have been obtained by Major J. W. Powell among the Pai-utes, and Mr. Paul Schumacher found corresponding implements in graves of Southern California.

The introduction closes with reference to the other valuable collections of the National Museum which illustrate the past or present condition of man in Central and South America, in Asia, Europe, and the other parts of the world.

The first division treats of the most numerous class of relics, namely, those of stone, which are fashioned either by the process of chipping, grinding, or polishing. The first category embraces rude pieces, flakes and cores as well as the more carefully wrought objects, such as arrow and spear heads, perforators, scrapers, cutting and sawing tools, dag-

ger-shaped implements, large implements supposed to have been used in digging the ground, and, lastly, wedge or celt-shaped tools or weapons. The ground and polished specimens, more defined in form, comprise wedges or celts, chisels, gouges, adzes, and grooved axes, hammers, drilled ceremonial weapons, cutting-tools, scraper and spade-like implements, pendants and sinkers, discoidal stones and kindred objects, pierced tablets and boat-shaped articles, stones used in grinding and polishing, vessels, mortars, pestles, tubes, pipes, ornaments, and sculptures.

The objects of copper are described under the following heads. They are either weapons and tools, or ornaments, and have been produced, as it would appear, by hammering pieces of native copper into the required shapes.

The third division embraces the specimens of bone and horn, consisting of perforators, harpoon-heads, fish-hooks, cups, whistles, drilled teeth, &c.

Under the fourth head are enumerated the various objects made of shells. They are either utensils and tools, such as drinking-cups, spoons, fish-hooks, celts, &c., or ornaments, comprising various kinds of gorgets, pendants, and beads.

In the fifth division, which treats of ceramic fabrics, the vessels obtained from mounds of the United States as well as the more elaborate specimens of Mexican fictile art, are described and figured.

Under the sixth head the wooden objects of early date are enumerated. Their number is not very considerable, owing to the perishable character of wood.

In the first appendix the aboriginal methods of hafting stone and bone implements are described and illustrated by eighteen drawings. The second appendix shows the system adopted in classifying the Smithsonian collection, illustrative of North American ethnology.

The implements and samples of workmanship which the Institution has collected furnish a knowledge of the condition of the arts among the primitive people who inhabited this continent. There is, however, another class of ethnological information which cannot be derived from such objects. We allude to the manners and customs of the people, the ceremonies they observe, the myths they transmit, and the religious systems they have adopted. As a general rule it may be assumed that for any usage or ceremony found among them for which no reason can be given there was a corresponding usage in ancient times which had a direct relation to the condition of the people at that time. Hence in order to reconstruct the past history of the different races of men it is of great importance to discover the survivals of the past in present usages. The especial attention therefore of those who have an opportunity of studying those tribes of Indians which have come least under the influence of civilized man has been directed to obtaining accurate information as to the points we have above enumerated.

Indian vocabularies.—For a number of years the Institution has been collecting, as a part of its work in the line of ethnology, Indian vocabularies, and of these the number amounts to 670. They were placed in the charge of J. H. Trumbull, LLD., of Hartford, Conn., for critical examination and arrangement for the press. It was the intention of the Institution to publish these vocabularies as a part of the volumes of the Smithsonian Contributions to Knowledge, and also in a separate form for more general distribution to philologists actually engaged in the comparative study of languages of savage tribes. An offer, however, was made by Maj. J. W. Powell, who had also collected a series of Indian vocabularies, to adopt those of the Institution, and to publish the whole in connection with his researches under Government in regard to the ethnology of the Indian tribes inhabiting the country watered by the tributaries of the Great Colorado of the West. In accordance with the general policy of the Institution in not expending its funds on anything which can be as well done by other means, the proposition of Major Powell was accepted, the only conditions exacted on which the transfer was made being that full credit should be given in the publication to the name of Smithson for collecting and arranging the articles, and also that extra copies be furnished the Institution for liberal distribution.

In connection with these vocabularies the Institution has also transferred to Major Powell, for publication, a grammar of the Ponka language, by Rev. J. Owen Dorsey, of Maryland, who resided for several years as a missionary among the Ponka Indians.

The Institution has also transferred to Dr. F. V. Hayden for publication, in connection with his explorations, the following articles, giving an account of the result of ethnological explorations undertaken under the auspices of the Institution:

"Researches in the Kjökkenmöddings and graves of a former population of the coast of Oregon, the Santa Barbara Islands, and the adjacent mainland." By Paul Schumacher.*

"The Twana Indians of the Kokomish reservation in Washington Territory." By Rev. M. Eells.*

These will also be published with due acknowledgment to the Institution, and extra copies furnished for distribution to its ethnological correspondents.

New edition of ethnological instructions.—In March, 1861, the Smithsonian Institution published a paper entitled "Instructions for Research relative to the Ethnology and Philology of America," prepared by Dr. George Gibbs, an octavo pamphlet of 51 pages divided into two parts, the first relating to ethnology, the second to philology. Under the first head Dr. Gibbs treated of the facts that should be observed and the

* Published in Bulletin of the United States Geological and Geographical Survey of the Territories. Vol. III, No. 1. April, 1877.

material collected, relating to crania, specimens of art, &c., names of tribes, geographical position, number, physical constitution, picture-writing, dress, food, dwellings, arts, trade, religion, government, social life, war, medicines, literature, calendar, and astronomy, history, and antiquities. Under the head of philology he gave a brief account of some of the peculiarities of the Indian languages, with general directions for the best methods of collecting certain words, a simple and practical alphabet, and a comparative vocabulary in English, Spanish, French, and Latin. This vocabulary contains 211 words. The whole was followed by an Appendix A, "Physical Character of the Indian Races," with a tabulated statement on particulars of inquiry, and also an Appendix B, relative to "Numeral Systems."

This paper has been distributed widely among the missionaries, Indian agents, travelers, and local collectors in ethnology, and has served a valuable purpose, resulting in the collection by various persons of the large number of vocabularies previously mentioned, and which comprise nearly all, the languages and dialects of the Indian tribes of the United States, and many in British America and Mexico. It served also to direct inquiry in the several branches of ethnography, resulting in the collection of many valuable notes and minor papers on this subject and many articles illustrating the industries, arts, means of subsistence, &c., among the Indian tribes. It has stimulated investigation throughout the country, giving direction to inquiry, while the results have abundantly proved the value of the instructions and the wisdom of their publication.

The demand for this work has been such that it is deemed important to publish a new edition of it, more comprehensive in plan and more elaborate in detail.

First. It is found necessary to enlarge the alphabet so as to include a wider range of sounds which have been discovered in the North American languages.

Second. It is necessary to enlarge the vocabulary so as to modify it somewhat as experience has dictated, and that new words may be collected.

Third. It is desirable that many simple sentences should be given, so chosen as to bring out the more important characteristics of grammatic structure.

This work, which will form a manual of ethnography, has been undertaken in behalf of the Institution by Prof. J. W. Powell, aided by several eminent ethnologists and philologists, and is well under way.

In this connection I may mention that John Howard Payne, author of "Home, Sweet Home," in 1848 presented to the Institution for publication a large amount of manuscript giving an account of the manners, customs, myths, and religion of the Cherokee Nation previous to its removal from Georgia. He was shortly afterward re-appointed Ameri-

can consul at Tripoli, on the occasion of which he withdrew the manuscript for revision and preparation for the press. He took it with him to his distant post of duty, with the intention of returning it to the Institution, but his sudden death prevented the realization of this intention. We have made inquiry in regard to this manuscript, but have been unable to obtain any information as to what has become of it.

An account of the large additions to the department of ethnology during the last year will be found in the report on the Museum.

MISCELLANEOUS.

The Institution, as in former years, has been in harmonious co-operation with the Department of Agriculture, the Army Medical Museum, and the Corcoran Art Gallery. With the first it has deposited plants and other articles relating to agriculture; to the second it has transferred a large number of articles pertaining to comparative anatomy and materia medica, and has received in return ethnological specimens; in the third, the Corcoran Art Gallery, it has deposited a number of engravings.

Chemical Laboratory.—During a part of the past year the laboratory of the Institution has been in charge of Dr. Oscar Loew, the chemist and mineralogist of the Wheeler Survey, during which time, besides analyzing various mineral waters and other substances collected by that expedition, he has made a series of analyses of minerals for the Institution.

Photography.—In the photographic laboratory, under the direction of Mr. T. W. Smillie, a large number of photographs have been made of ethnological and natural-history specimens. The Institution has continued during the past year the collection of photographic likenesses of cultivators of science in all parts of the world, the whole number received up to this time being over twelve hundred.

Light-house duty.—I have been a member of the Light-House Board since its organization, and during this time have discharged the duty of chairman of the committee on experiments. To the discharge of the duties connected with this service I usually devote one day in the week, and the greater portion of my summer vacation to light-house investigations. A considerable portion, however, of the vacation last year was expended in acting as one of the board of centennial judges. On this account the researches on sound as applied to fog-signals have been deferred until another season.

Fish Commission.—The investigation in regard to food-fishes and the methods of their propagation, for which an appropriation for several years has been annually made by Congress, has been continued under the direction of Professor Baird. This work was commenced in 1872, and has been prosecuted with satisfactory results to the present time.

NATIONAL MUSEUM.

The National Museum was established by the Government in 1842, at which time it consisted principally of specimens collected by the Wilkes exploring expedition. It was transferred from the Patent Office to the care of the Smithsonian Institution in 1858, where it has been enlarged by all the collections made by exploring and surveying parties of the several bureaus of the War, Navy, Treasury, and Interior Departments, and those of the Smithsonian Institution. At first $4,000 only was annually allowed by Congress for the care and exhibition of the specimens. In 1871 the appropriation for this purpose was increased to $10,000, in 1872 to $15,000, and for the last two years to $20,000. Nothing, however, has been allowed for the rent of the building, which was erected exclusively out of the income from the bequest of Smithson.

The following report from Professor Spencer F. Baird, assistant secretary, gives an account of the additions to the museum and the various operations connected with it during the year 1876:

REPORT OF PROF. SPENCER F. BAIRD ON THE ADDITIONS, &C., TO THE MUSEUM IN 1876.

Increase of the Museum.—At no period in the history of the National Museum, from the time when it was organized to the present, has the increase been so great as during the year 1876. A sudden and abrupt augmentation began in 1875, reaching its culmination in 1876. In the absence of funds for the purchase of collections, the ordinary means of increase have been derived, first, from the contributions of Smithsonian correspondents, either spontaneous, or invited with a view of securing material for some particular research; second, from the specimens collected by the various Government surveys and exploring expeditions and transferred to the Smithsonian building in accordance with the law of Congress; and, third, by the exchange of specimens with private individuals or public establishments at home and abroad.

During the two years just past the most important means of increase has been the United States International or Centennial Exhibition of 1876, which has just passed into history as the most extensive and successful of world's exhibitions of natural products and general industries.

In addition, however, to the sources of increase to the Museum during the years 1875 and 1876, mentioned above, still another presented itself of perhaps even greater productiveness, viz, acquisitions from foreign exhibits. With scarcely an exception, the best and most important of these were presented to the United States at the close of the exhibition, embracing, as they did, many complete series of objects, illustrating the geology, metallurgy, the ethnology, and the general resources of all nations. Of about forty governments and

colonies, the choicest of the exhibits of thirty-four were presented to the Smithsonian Institution for the National Museum, the remainder either having nothing to give or being restricted in the disposal of their articles.

It was, however, not from foreign commissions alone that collections were received by the Institution. Several entire State exhibits, and many belonging to private parties were also added to the general increase. Nevada, Montana, and Utah presented the whole of their mineral exhibits, while partial collections were received from several other States and Territories.

Of the general collections received during the year, the most noteworthy are the zoölogical specimens brought together by Lieut. George M. Wheeler, during his recent survey, and turned over by him to the museum in accordance with the law of Congress.

Engineer William A. Mintzer, of the United States Navy, also contributed a number of packages, containing collections of natural history and ethnology from Arctic America, collected by him while engaged in mining isinglass on Admiralty Island, north of Hudson's Straits.

The general ethnological collections obtained during the year (principally as the result of expenditure from the centennial fund of the Indian Bureau) are of very great extent. Among the most important may be mentioned those of Mr. James G. Swan, from Vancouver Island, Alaska, and Washington Territory, illustrating the habits of the highly ingenious Northwestern Indians, the more conspicuous of these being the front of an Indian house, a number of carved wooden columns for ornamental purposes, some of them 30 feet long and 8 wide, carved from a single log and properly ornamented, and a dug-out canoe, 60 feet feet long and eight wide.

Mr. Paul Schumacher, in continuing his archæological labors on the south coast of California, made many important acquisitions, adding materially to the variety he had previously gathered. Some additional objects of interest were also received from Rev. Stephen Bowers, of Santa Barbara. Dr. W. W. Hays, of San Luis Obispo, formerly connected with the Smithsonian Institution, also presented a large number of objects, while additional collections were also received from Mr. Stephen Powers, principally of illustrations of the life and customs of the Indians of Nevada and California.

The parties sent out by Major Powell, at the request of the Indian Bureau, to make collections illustrative of the Indians of New Mexico, especially of the Moquis, obtained an extensive collection, including pottery both ancient and recent, stone implements, dresses, &c.

One of the most interesting and important additions to the ethnological collection consisted of carvings of bone and stone implements, contributed by Mr. Lucien M. Turner, United States signal observer at Saint Michael's, on Norton's Sound, south of Behring's Straits. This series, in the number of pieces and variety of shape, the character of

the ornaments, &c., is one of the most striking of its kind ever contributed to the museum.

Additional collections of objects were also received from Capt. A. W. Corliss, United States Army, stationed at Tucson.

Not less interesting and important were the archæological collections received from Nicaragua. Dr. Earl Flint, of Granada, furnished many additional specimens to his previous transmissions.

To Dr. J. F. Bransford, United States Navy, is due the most important acquisition ever made from Central America, in the form of a very large number of objects exhumed from Indian graves on the island of Omotepec, in Lake Nicaragua. These were especially interesting as being found between successive sheets of volcanic eruptions, thus giving a comparative chronology to the objects.

A series of objects illustrative of the *Ainos*, or hairy men of Jesso, furnished by Mr. B. S. Lyman, are of signal interest.

The most important contributions among the mammalia consisted of collections of fur-seals and sea-lions from the Alaska Commercial Company, and a series of eight skins of sea-lions of the California coast (*Zalophus gillespii*) and presented by Capt. J. G. Baker, of the United States revenue marine.

No very large collections of birds were received during the year, with the exception of those from Lieutenant Wheeler's party, although the specimens furnished by Engineer Mintzer from Greenland, by Dr. Hering from Surinam and elsewhere, are noteworthy.

Numerous reptiles in small lots were brought in from various sources. Of fishes, the acquisitions were numerous, consisting mainly of transmissions by agents of the United States Fish Commission. As heretofore, Mr. Vinal N. Edwards, of Wood's Hole, made many important contributions, among which were some fifteen species additional to the known fauna of that locality, which for many years has been the chief station of the Fish Commission.

Mr. Thomas J. Moore, curator of the free public library of the city of Liverpool, transmitted a number of species of English fishes packed in ice for the purpose of having casts made and added to the collections of the Institution. These were consigned first to Mr. E. G. Blackford, of Fulton market, who repacked them in ice and shipped them to Washington. For this, as well as for a continuation of the services of this gentleman in the prompt transmission of rare fishes, the Institution is under great obligations. A special service rendered by him was the transmission, day by day, to the Fish Commission exhibit at the Centennial of all the varieties of fresh fish as they made their appearance in the New York market. Their preservation in large refrigerators, erected at his suggestion by Messrs. Allegretti and Banta, constituted a great source of attraction to the Centennial visitor.

The exhibit made of the fisheries of the United States derived a great deal of its value from the co-operation and contribution of various

parties who fully appreciated the importance of making a satisfactory competitive display in view of the anticipated rivalry of foreign governments. Among these, acknowledgment is especially due to Messrs. Bradford & Anthony, of Boston, for undertaking to bring together the fullest series of objects used by the American angler; to Messrs. A. R. Crittenden & Co., of Middletown, Conn., who in like manner prepared the collection of boat-fittings, fisherman's equipments, clothing, &c.; to the American Net and Twine Company, of Boston and New York, which supplied samples of nets of all kinds, models of pounds and fishing-boats, and furnished also miles of netting to serve as ornamental drapery to the building. Mr. J. H. Nichols, of Syracuse, and Mr. Thaddeus Norris, of Philadelphia, also supplied from their private collections a number of angler's equipments.

Here, as in the case of other objects, space does not permit more extended mention; but the detailed enumeration will be found in the list of donations.

The additions to the collections of minerals were enormously large, the principal and most important being a series of ores of the precious metals collected in California, Oregon, Nevada, Utah, Idaho, and elsewhere, by Mr. Thomas Donaldson, and representing a money value far greater than its actual cost, in view of the donation of the specimens by the owners and the agents of various mines.

The collections made by Professor Blake on Lake Superior, by Mr. G. C. Brodhead in Missouri and elsewhere, by Mr. Maury in West Virginia, and by other parties, were also noteworthy. By far the most valuable direct donation, however, was that of the collection of ores and minerals of Nevada collected by the State Centennial board and exhibited with the Smithsonian display. These, with all the cases in which the specimens were exhibited, were presented to the National Museum by the authority of the legislature of Nevada, the same disposition having been made of the very valuable collections of Montana and Utah. Gen. J. H. Wilder, of Chattanooga, presented a large number of specimens from Tennessee. Other series of more or less note will be found detailed in the list of donations.

The present of three large boxes filled with choice minerals of Japan by the government of that country is also a noteworthy addition.

It will be seen from the preceding enumeration that all parts of North America are represented in the accessions of 1875 and 1876, and so uniformly indeed that no one region can be indicated as more worthy of notice than another.

From Central and South America have been received collections in ethnology and zoölogy; from the South Pacific a general collection in natural history; from Japan collections in ethnology and mineralogy. Apart from the Centennial donations comparatively little has been sent in from Europe, a few specimens of birds and ethnological objects representing the series. With the acquisitions made at Philadelphia,

however, no part of the world is really unrepresented, as shown by the enumeration of foreign commissions which presented either the whole or a considerable portion of the objects they exhibited from the animal, vegetable, and mineral kingdoms, or as illustrating their ethnology or industries.

It is quite impossible to give, in the limited pages allotted to the present report, anything like a complete statement of the objects thus added to the treasures of the National Museum from the five principal sources thus mentioned. In the Appendix, however, will be found a general statement of the more important objects presented by foreign commissions, arranged alphabetically by countries, the remaining additions being given under an alphabetical list of donors. The catalogue of the display made by the Smithsonian Institution and Fish Commission at the Centennial, for the publication of which it is hoped Congress will shortly make provision, will give a minute enumeration of all objects obtained on that occasion.

Work done in the Museum and at Philadelphia.—As might have been expected, the numerous additions to the collections, resulting from the various donations above referred to, required a corresponding increase of the personnel of the Museum, and a very large force was temporarily employed in receiving and unpacking collections, in preparing them properly for exhibition, in mounting them for suitable display, in cataloguing, entering, and labeling them, in packing for shipment to Philadelphia, in unpacking and arranging there, in caring for them during the exhibition, in repacking and shipping to Washington, and in disposing of them properly at the end of their journey. The funds for this additional service were derived from the special appropriation made by Congress for the purpose. To facilitate the work, several divisions were organized; that of ethnology, under the charge of Dr. Charles Rau, assisted by Dr. Edward Foreman and Mr. Frank H. Cushing; the mineral department, under Prof. William P. Blake, assisted by Mr. Thomas Donaldson; the animal and fisheries divisions were in charge of Mr. G. Brown Goode, assisted by Mr. T. H. Bean and Mr. H. C. Chester.

A series of plaster casts of the fishes, reptiles, and cetaceans of North America was prepared and painted to represent the colors of the living animal. The preparation of the skeletons of whales and other animals of economical interest was done partly at the establishment of Henry A. Ward at Rochester, and partly at the Institution.

The aggregate of the entries of specimens in 1876 amounted to 23,675, showing a very large increase over the entries of 1875 (12,578) and still more over those of 1874, (10,332.)

An accompanying report upon the operations of the Smithsonian Institution, as connected with the centennial display, will give the necessary details in regard to the operations at Philadelphia during the summer,

although it may be stated here, in brief, that while the mounting of the specimens, or arranging them in a suitable form for exhibition, was carried on during the whole of the period, the actual packing up and boxing of the specimens began in March, and their shipment in April. Twenty-one car-loads of specimens were forwarded from the Smithsonian Institution, and these were unpacked and put in place with such rapidity, that by the 10th of May, at the opening of the exhibition, comparatively little remained to be done, the whole labor being completed within the subsequent few weeks.

On the 10th of November the work of packing the specimens for their return to Washington was commenced, but was soon arrested by an order of the President directing everything to remain as it was, pending the action of Congress in regard to the erection of a suitable building for the Government exhibit, as more fully detailed in the accompanying report. The interval, however, was made use of in transferring the donations made to the United States by foreign governments and American States and individuals from their previous place of exhibition to the Government building. As soon as the embargo as to packing was removed, these collections, with others constituting the summer's exhibit, were boxed and held in readiness for the anticipated order of the President for their transfer to Washington.

In addition to the twenty-one car-loads of objects moved to Philadelphia from Washington, a large portion of the exhibit of the Smithsonian Institution, arriving from other directions was put in place. Almost the whole of the mineral display was in this category, only one load having gone from Washington.

The collections transferred to Washington after the close of the Exhibition were more than thrice the bulk of those that were taken thence to Philadelphia in the spring, the entire shipment returned occupied forty-two cars, representing approximately an aggregate of 812,000 pounds.

This may be a proper occasion to acknowledge the very great liberality of the railroad companies in regard to the collections in charge of the Smithsonian Institution, and without which the funds at its command would have been inadequate to meet the expense of transportation. By an agreement between the railroad companies and Captain John F. Rodgers, the officer in charge of transportation to and from Philadelphia of the Government collection, full rates were to be paid one way; but all objects thus transferred were to be brought back free of charge. Thanks, however, to the liberality of the Philadelphia, Wilmington and Baltimore, the Baltimore and Potomac, and the Pennsylvania Railroad Companies, no charge whatever was made on the twenty-one car-loads taken to Philadelphia in the spring; and the same companies agreed, without inquiring into the nature of the contents, to bring back to Washington the same number of cars free of expense—additional car-loads to be paid for at the usual rates. It was

under these conditions that the liberality of the Philadelphia, Wilmington and Baltimore Railroad, in furnishing, as far as they could be used, hay-cars of extra size, was of so much importance, as it enabled us to pack in a portion of the cars at least 50 per cent. more than in ordinary freight-cars. The remissions of the freights to Philadelphia from various points are due largely to the efforts of Mr. John S. Wilson, of the Philadelphia, Wilmington and Baltimore Railroad Company, acting under the authority of Mr. Isaac Hinckley, president of the road, and to those of Mr. Kingston, of the Pennsylvania Railroad.

Scientific investigation of collections.—In view of the constant labor required in receiving the collections and putting them in proper form for the Philadelphia exhibition, it was impossible to devote much effort to the critical investigation of the collections and their use as material for scientific purposes, although a number of the specimens were placed in the hands of correspondents and collaborators for careful examination, among which are the following:

Mr. Robt. Ridgway, in charge of the department of mounted animals, has continued his investigation of the birds in the National Museum, and has arranged and labeled the entire American collection, involving the handling of over 30,000 specimens.

Mr. George N. Lawrence has examined certain obscure species of the ornithological collection, new to science.

The *Rodentia* have been investigated by Dr. Elliott Coues, who has prepared therefrom material for an elaborate monograph to be published in Professor Hayden's series of reports. Several new species have rewarded his labors. A preliminary report has lately been made by him of the shrews, which will form the subject of a second work by the same author.

Prof. Edward Cope has received various collections of reptiles from the Institution, and has submitted them to careful examination.

Dr. Thomas H. Streets, surgeon United States Navy, has been engaged during the year in investigating the collection of vertebrates and other animals obtained by him during a recent United States survey of the South Pacific and the Gulf of California made by the United States ships Portsmouth and Narragansett. He has discovered several new species, an account of which, with his other notes, will be published in the Bulletins of the National Museum.

Professor Gill has continued his labors upon the general and systematic arrangement of the mammals and fishes.

The ethnological collection has also been the subject of considerable inquiry. Professor O. T. Mason, of Washington, has undertaken a memoir upon a remarkable collection of stone implements from Porto Rico, presented to the National Museum by the late Mr. George Latimer. This will be fully illustrated and form part of the report of the Institution for 1876.

Dr. Rau has prepared a work on the American stone age, to serve as a guide to the archæological exhibit of the United States, and which has been published by the Institution.

Dr. James Lewis has completed, during the year, his investigation of the fresh-water and land shells of the United States belonging to the Museum, and has carefully identified and labeled the species. A series was reserved by him for the Museum and the duplicates made up into sets for distribution.

Dr. Edward Foreman has also thoroughly identified the vegetable substances used by the American Indians as food, medicine, narcotics, paints, &c., and has made up numerous sets for distribution to ethnological establishments.

Distribution of duplicate specimens.—The same reasons which prevented the usual effort in regard to researches among the collections has more or less interfered with the distribution of duplicates during the year; but as the amount of material available for the purpose has been greatly increased as a result of the Centennial collections, it is hoped that the coming year will permit an unusual amount of effort in this direction.

A considerable number, however, of zoological, mineralogical and ethnological specimens, either singly or in sets, have been sent off as direct donations or exchanges. Their aggregate, including that for 1875, will be found in the usual table of the appendix.

Present condition of the Museum.—The great enlargement of the Museum has commensurately expanded its means for scientific and practical instruction. In many departments it may claim very great eminence, entitling it, on the whole, to rank with the largest European collections, while in some respects, especially as regards the ethnology, mineralogy, and zoology of North America, it may fairly be said to occupy the very first place among museums of the world. The immense mass of duplicates now in its charge also constitutes so much material for increasing the present number of species, and when proper facilities are afforded for unpacking and arranging its reserve series, great additions can be made by a suitable system of exchanges. At present, however, everything looking toward such final arrangements is contingent upon provision by Congress in the way of increased accommodations, since the present available space is entirely inadequate to the purpose.

The Museum portion of the Smithsonian edifice consists of two rooms of about 10,000 feet area each, with a connecting range and gallery of about 5,000 feet. The specimens in cases are at present very much crowded, while very many others are in boxes, occupying the passages and intermediate spaces. The basement of the Institution, nearly 400 feet long, is a series of store-rooms, for the reception of portions of the collection not yet exhibited in the upper halls, and thus without benefit

to the general public. Among these objects are very many skeletons, beautifully prepared by Professor Ward, some 40,000 jars of alcoholic specimens, together with several hundred large copper tanks, likewise filled; over 50,000 skins of birds, of which at least 15,000 should be mounted and placed in the general collection; several thousand skins of mammals; large numbers of fossil vertebrates, minerals, ethnological objects, &c.; these, for the most part, not duplicates, but simply specimens for which there is no room elsewhere.

An estimate of 25,000 square feet, or a space equal to that of the upper halls, is by no means extravagant for the proper display of the specimens thus excluded. Anticipating the necessity of increased accommodations for the Centennial collections and accessions, the Smithsonian Institution, in 1875, made application to Congress for the use of the Armory building in the square between 6th and 7th Streets, an edifice 100 feet by 50, having four floors. This it was supposed would be adequate, at the close of the Centennial, for the reception and exhibition of at least the fishery exhibit and that of economical mineralogy. So great, however, was the surplus of Centennial material to be provided for that the building is now filled with boxed specimens, occupying for the most part the entire space from floor to ceiling of each room. The building is not fire-proof, and although the specimens in it represent some of the most valuable and important of the series, there is nothing to prevent their destruction by fire, or injury from damp, vermin, or other causes, a result which would constitute an irreparable loss.

As the four floors of the Armory referred to present 20,000 feet of area, an estimate of 50,000 feet for the proper display of the specimens now stored in them cannot be considered extravagant, thus making the entire additional space required, 75,000 square feet. Only one-fourth of the specimens in charge of the Institution are at present on exhibition, the remainder being entirely withdrawn from public inspection, so that the necessity for prompt effort to secure the proper accommodations will be readily nuderstood.

There can be no question as to the scientific and industrial value of the specimens thus added to the national collections, as they consist, not of the ordinary objects of natural history alone, but of those which show the natural and industrial resources of the country, and constitute, in very great part, that material which to the American manufacturer and producer is of the utmost value as constituting the objects of their study. Indeed, their acquisition by the United States tends to render the benefits of the international exhibition permanent to a great degree; it is, therefore, of importance that, while the lessons of the exhibition are still fresh in mind these objects should be exhibited and attention invited to them. Numerous applications have already been made for permission to make a study of the objects, which, on account of the impossibility of furnishing space for unpacking them, for the most part have been refused. The great number of duplicates, too, should be

distributed as speedily as possible to the various points throughout the country requiring them. Of course, this cannot be done under present circumstances.

Nature of increased accommodations required.—In view of the fact that the collections for which provision is needed represent a bulk of at least three times the present capacity of the Smithsonian building, it is evident that to accommodate these, and to make reasonable provision for probable increase in the future, a building of great magnitude will be required. If, however, this be constructed according to the usual plan of Government buildings in Washington, the expense would be so very great as to render it doubtful whether the necessary appropriation can be obtained, and in any event the period of time required for completing the edifice would extend over so many years that the greater part of the collections now boxed might be destroyed by rust, decay, the attacks of insects, &c., while the country would lose the stimulus of the exhibition and the benefits of its study.

Any new edifice should be in connection with the present Smithsonian building, and, in a measure, form its extension, so that the entire National Museum might be together, and a single supervision extended over the whole.

After a careful consideration of the problems relating to the subject of a building, a plan has been settled upon to be presented to Congress for its consideration, which, it is believed, embraces, in a very marked degree, the requirements of economy, space, convenience, comfort, and freedom from danger of fire. The idea of this was suggested by General Meigs as the result of his special inquiries into public buildings and museums abroad, and the details have been worked out by Mr. Cluss. This involves an edifice with a floor area 300 feet square, and so arranged as to be capable of being excellently lighted. A concrete floor is proposed, for the purpose of keeping out moisture and preventing the lodgement of vermin, with brick walls and an iron, slate, or metal roof. It is believed that such a building can be completed and provided with the necessary heating-apparatus at a cost not to exceed $250,000, or about $2.84 per square foot. By its simplicity and uniformity of structure, and the absence of cut-stone or carving, it is thought that the whole can be completed and ready for occupation within ten months' time from its commencement.—S. F. BAIRD.

GOVERNMENT EXPLORATIONS AND SURVEYS.

The following are brief accounts of the principal explorations of the Government in 1876, from which specimens will be derived for increasing the collections of the National Museum. They are furnished by the several directors of the explorations.

1. *Under Lieut. George M. Wheeler, Engineer Department, U. S. Army.*—The geographical surveys west of the one hundredth meridian, under

First Lieut. George M. Wheeler, Corps of Engineers, United States Army, and reporting to Congress through the Engineer Bureau of the War Department, were begun in 1869. In that year the present officer in charge, while making reconnaissances for routes of communication through Southern Nevada, conceived the idea of extending the work to other portions of the Military Department of California. A plan for the prosecution of the same was presented while elaborating the results of that year's work. Lack of funds prevented operations in 1870, but in 1871 parties again took the field in Nevada, California, and Arizona.

At that time the work received its principal support from the appropriation for "Surveys for Military Defenses," under which head it naturally fell. In 1872, however, Congress appropriated special means and a more complete organization was made, the survey being prosecuted principally in Utah, but also in Arizona and Southeastern Nevada. In 1873 the character of the methods employed upon this work advanced in proportion with the prospect of its development into an accurate geodetic survey, extending over large areas. During this season many points accessible to the telegraph were occupied for completing the system, now extending from Eastern California, Nevada, and Northern Arizona to the eastern base of the Rocky Mountains. In 1874, connection between the east and west portions was made more perfect. In 1875 the operations of the survey were conducted in two divisions, designated as the California and Colorado sections, the former acting in portions of the southern sierras and extending from the branches of the coast-ranges south of latitude 37°, eastward toward the Colorado desert, while the latter expanded the finished area of 1873 and 1874 in Colorado and New Mexico.

The distribution of areas surveyed thus far is as follows:

	Square miles.
In Nevada	58,940
In California	40,625
In Arizona	60,120
In Colorado	37,550
In Utah	44,015
In New Mexico	53,236

The maps issued to date cover areas as follows:

	Square miles.
On a scale of 1 inch to 8 miles	192,217
On a scale of 1 inch to 4 miles	13,028
On a scale of 1 inch to 2 miles	1,091

During the season of 1875 one party of the California section continued examinations for determining the practicability of diverting the Colorado River for the purpose of irrigation. The report of Lieutenant Bergland on this subject, and the information already submitted by the officer in charge of the survey, are sufficiently full to place this matter at rest for the present.

Aside from the topographical work of 1875, gratifying results in ethnological research were obtained by a party of the California section under Dr. H. C. Yarrow, detailed for that purpose. Extensive burial-places were discovered, and it is estimated that the remains of no fewer than 5,000 individuals were exhumed. The valuable collection made has been submitted to Professor F. W. Putnam, of the Peabody Museum of Archæology, for examination and study. Dr. Yarrow's report fully describes the explorations of this party.

The geology of portions of Southern California, Arizona, New Mexico, and Colorado was examined and reported upon by Prof. Jules Marcou, Dr. Loew, and Mr. A. R. Conkling. Professor Marcou makes valuable additions to the knowledge of the field visited by him. Dr. Loew describes much of geological interest in his work of the year, besides making a large collection of specimens. He also determines the chemical composition of alkaline and other deposits, and of the waters of thermal and mineral springs of Southern California, and analyzes the ores from several mines. Mr. Conkling made a rapid and interesting examination of the mountain geology from La Veta Pass to the head of the Pecos River. Much valuable mining information of a descriptive character was obtained by the different parties.

The meteorological and hypsometrical methods, as described by Lieutenant Marshall, show a commendable state of efficiency. The economic botany and agriculture of Southern California received careful consideration from Dr. J. T. Rothrock, acting assistant surgeon United States Army, and his observations cannot fail to interest those in search of information regarding that country. In the field of zoology Mr. H. W. Henshaw displayed his usual energy. During the season 700 ornithological specimens were secured, representing 127 species. The report of this gentleman describes the habits, peculiarities, and localities of these birds.

The operations of the season of 1876 were carried on in portions of Colorado, New Mexico, California, and Nevada. The Colorado party, traversing atlas-sheets 52, 53, 61, and 62, occupied 10 main and 51 secondary triangulation stations, with numerous three-point, sextant latitude, and meander stations, covering an area of 4,800 square miles. The party in New Mexico, operating upon an area of 7,500 square miles, in atlas-sheets 62, 69, 70, 77, 78, and 84, occupied 15 triangulation, 191 three-point, and a large number of subordinate stations. Corresponding results were obtained by each of the four parties acting in Nevada and California. Base-lines were measured at Sutro, Nevada, and Colorado Springs, Colo.

The working force of the season was disposed as follows: (1) the California section, in charge of Lieutenant Wheeler, with its several parties under the command of Lieutenants Tillman, Symons, Birnie, and Macomb; (2) the parties of the Colorado section, under Lieutenants

Bergland and Morrison; (3) the office force in Washington, temporarily in charge of Mr. George M. Lockwood.

The two sections were rapidly organized, and, except in case of the New Mexico party, were placed in areas readily approached, in order to gain full advantage of the season, rendered necessarily short by the lateness of the appropriations. The results accomplished are of more than usual value. The detailed topographical notes from that part of the Sierra Nevada within which lies Lake Tahoe, surrounded by a number of outlying miniature lakes, will admit of publication upon a scale of 1 inch to 1 mile. Minute topographical details, by the plane-table method, admitting of reproduction on a scale of 1 inch to 500 feet, if required, were gathered in the vicinity of Virginia City, Nev., by a party dispatched thither for the purpose of measuring a base-line.

As the result of this season's barometric work, 749 cistern-barometer and 3,804 aneroid stations were occupied. The highest point reached was Pike's Peak, 14,150 feet; the lowest was Sulphur Springs, Nev., 3,575 feet. Fourteen mining-camps were visited.

During the past year the following publications have been made: 1 progress-map; 2 crayon atlas-sheets; 7 topographical atlas-sheets; 6 geological atlas-sheets; map of Lake Bonneville, (restored outline of an ancient fresh-water lake;) preliminary report of 1869, revised edition; annual report of 1876; Volume III (Geology) of general report; Part I (Invertebrates) of Volume IV, (Paleontology;) and Volume V, (Zoölogy.) Progress has also been made upon Volumes I, II, VI, and VII, and it is expected to have the MS. of three of them in the hands of the printer at an early date. The manuscript for Catalogue of Declination of 2,018 stars has gone forward.

The small amount of the appropriation did not admit of the employment of the usual number of geologists, zoölogists, &c., but Mr. A. R. Conkling, as geological assistant, and Mr. H. W. Henshaw, as zoological collector, accompanied the California section. Observations in geology were confined chiefly to the eastern and western summits of the Sierra Nevada Range. Abundant evidence of the former existence of glaciers is found in the mountains on the southwestern side of Lake Tahoe. Glacial scratches were observed on Tallac Peak. Vast surfaces of rock have been polished and grooved by these moving masses of ice, and well-marked terminal moraines are seen on the southern banks of the lake. Some very picturesque lakes occur in front of Tallac Peak, and, according to Prof. Jos. Le Conte, who has studied this region carefully, these lacustrine areas have been scooped out by glacial ice.

Near Lick's Point, Lake Tahoe, a compact phonolite is found. The northern side of the lake is bounded by granitic ridges. In the Eastern Summit there are several ore-deposits. The principal mines are the Montreal, Emerald, Niagara, and Clear Creek Cañon. The Carson Valley contains numerous hot springs, and several basaltic buttes occur on the plain of Carson City. About one mile east of the town a mass

of yellow sandstone outcrops, which is fossiliferous, the bivalves of the genus *Unio* being very numerous.

The work of Mr. Henshaw, collector in zoölogy, was mainly confined to the vicinity of Carson City, Nevada, and the region contiguous to Lake Tahoe. In the character of its avian fauna the pine region of the eastern slope of the Sierras was found to nearly resemble that of the western side, and some birds, distinctively Californian in nature, were ascertained to range down to the foot-hills on the borders of the sage-brush plains of Nevada.

The fish of the various streams and lakes of this well-watered region received careful attention, and extensive collections were made. Specimens of such insects as remained at this late season were collected, and, though the results are not large, it is more than probable that they include a number of novelties, especially among the Orthoptera.

The section of country visited will prove of most value for timber, grazing, and mineral purposes, as in most instances the altitude of the high interior mountain-ranges precludes the certainty of crops, even where there is arable ground. In favorable exception to this rule, however, may be noted the land in proximity to Honey Lake, in the northern part of the California area, and on either side of the Rio Grande, below Albuquerque, in New Mexico.

An important feature of the present stage of the survey results from the instructions which require each chief of party or topographer to take notes sufficiently detailed to permit the plotting, upon resource-sheets, of the limits between arable, irrigable, grazing, mining, and timber lands, indicating, also, those absolutely barren. In the office, in addition to the regular geographical atlas-sheets, certain preliminary maps have been arranged, from which will be prepared colored sheets, upon which areas will be so delineated as to readily convey to the eye the general capabilities of the section embraced. These delineations, together with the tabulated results of the season's observations, will give a complete account and almost perfect idea of the natural resources of the country and its availability for agricultural, mining, and grazing purposes, and will graphically separate the arid, barren, and otherwise worthless tracts from the better land. In future operations it is intended to procure complete statistics on these important points, and the material of former years having been digested, the comparison of large areas will then be practicable. In addition to the data disclosing the natural resources, the direction of drainage, with basin perimeters, will be indicated, and the amount of rain-fall determined as nearly as practicable. The sheets and tables will then furnish fair data for deciding upon the feasibility of irrigating by canals, reservoirs, and artesian-wells. These maps will be completed as rapidly as the limited force and relative importance of different portions of the work will allow.

Through an inadvertence on page 56 of the Annual Report of the Institution for 1875, it is stated in relation to geographical surveys west

of the one-hundredth meridian, that connection was had with the base-line measured by Captain, now Brig.-Gen. E. O. C. Ord, near Los Angeles, Cal., in 1854. The "base" in question was measured in April and May 1853, by Assistant George Davidson, United States Coast Survey.

2. *The work of the United States Geological and Geographical Survey of the Territories, under the direction of Professor Hayden, during the season of* 1876.—The United States Geological Survey for the season of 1876 was divided by Dr. Hayden into five parties for field-work. The late date at which the appropriation was made available delayed the commencement of the work until late in August, so that only the completion of the atlas of Colorado was attempted and successfully accomplished. The work of 1876 was therefore a continuation westward of that of the three preceding years, finishing the entire mountainous portion of Colorado with a belt of Northern New Mexico, 15 miles in width and a breadth of 25 miles, of Eastern Utah, and also a rectangle of Arizona, 15 by 25 miles. The areas of exploration are located in the interior, remote from settlements and largely on the reservation for the Ute Indians. Each party was assigned a special area for examination, which was so selected as to connect with each other topographically. The common point of departure was Cheyenne, in Wyoming Territory.

The main division or party of primary triangulation was under the charge of A. D. Wilson, and accompanied for part of the season by Dr. F. V. Hayden, director of the survey. The object of this party was to complete the primary triangulation of Colorado. The field was taken at Trinidad, the southern terminus of the Denver and Rio Grande Railroad, and the first station was made on Fisher's Peak, a point near Trindad. Marching thence westward through the Raton Hills, a station was made on Culebra Peak, one of the highest points of the Sangre de Cristo Range. Crossing the range, the next point was Blanca Peak, the highest peak in Colorado, one of the Sierra Blanca group of the Sangre de Cristo Range. Its elevation is 14,464 feet above sea-level. From the Sierra Blanca the party proceeded westward across the San Luis Park and up the Rio Grande to its source, making two stations on the way, one near the Summit district and the other on the Rio Grande Pyramid. From the head of the Rio Grande the Continental divide was crossed, and the next station made on La Plata Peak in the La Plata group of the San Juan Mountains. From this point the party turned northwest, traveling across the broken mesa country west of the Dolores, making three secondary stations to complete the topography omitted in 1875 on account of the hostility of the Indians. After occupying the highest point of the Sierra Abajo, one of the isolated mountain-groups of the plateau region, they went eastward to Lone Cone, where another station was made. Thence they proceeded northward, via the Uncompahgre agency, crossing the Gunnison and Grand Rivers to the plateau region at the head of White River, a branch of the Green.

The final station was made between the White and Yampah Rivers, in the northwestern corner of Colorado. In the two months he was in the field Mr. Wilson traveled 1,400 square miles, finished about 1,000 square miles of topography, and also made eleven geodetic stations, connecting by a system of primary triangles the whole of Southern and Western Colorado with the triangulation of the previous years. Mr. W. H. Holmes accompanied the triangulation-party as geologist. From the rapidity with which they were obliged to travel he was unable to do much detailed work, but he had an excellent opportunity to correlate the formations of the plains east of the mountains with those of the pleateau region on the west. As he had previously surmised, he found the structure of the Sierra Abajo to be identical with that of the other isolated mountain-groups to the south and east of the Abajo in in his district of 1875. A mass of trachyte has been forced up through fissures in the sedimentary rocks, and now rests chiefly upon the sandstones and shales of the Lower Cretaceous. The sedimentary rocks are arched from the intrusion of wedge-like sheets of trachyte, and the broken ends of the beds are frequently bent upward, as if by the upward pressure of the igneous mass. The division left the field about the 12th of October at Rawlins Springs, in Wyoming Territory.

The Grand River division was in charge of Henry Gannett, topographer, with Dr. A. C. Peale as geologist. James Stevenson, executive officer of the survey, also accompanied the party a portion of the season. The party took the field at Cañon City, August 23, and marched westward to the Uncompahgre agency, a few miles east of the lower district assigned to the division. The country assigned to it for exploration consisted of two detached portions, one of about 1,000 square miles, lying south of the Sierra la Sal and east of the Sierra Abajo, extending eastward to the Rio San Miguel and southward as far as the latitude of Lone Cone. The other lay north of the Grand River, extending from the river to the crest of the Roan or Book Cliffs. Its eastern limit was the meridian of 108° and the western 109° 30′, comprising about 3,000 square miles.

Work was commenced in the southern district early in September. The country surveyed is entirely made up of broken plateaus, almost without water, except in the Dolores and San Miguel Rivers, and several smaller streams. It has very little agricultural value, but portions of it would make fair winter-ranges for stock. The region, however, is geologically interesting, on account of several folds which, with the subsequent erosion, have beautifully exposed the several formations. Coal occurs at several places in the Cretaceous rocks, and on the Uncompahgre River, a few miles above the agency, there is semi-anthracite coal. Gold placers have been discovered on the San Miguel River, and in the mountains south of the district prospecting has been vigorously prosecuted. This portion of the San Juan mining region bids fair to become one of the most important and successful districts, as indicated by the developments already made.

The northern area is occupied by the valley of Grand River and the foot-hills of the Roan Plateau, forming the Book Cliffs. The valley of the Grand extends down the north side of the river for upward of a hundred miles, with an average width of 10 miles, and is at present about as valueless a piece of country as there is in any part of the West. There is no good water except in the Grand, which is in low cañon most of its course and consequently difficult of access. The soil is a bluish-gray alkaline clay, derived from the weathering of Cretaceous shales, which, when dry are deep and powdery, and when wet become a mud of almost incalculable depth. There is but little vegetation of any kind. Part of the valley might be irrigated from the river and thus become of value. The geology is comparatively simple, the different formations dipping away from Grand River in regular order from Triassic to Green River Tertiary, the latter forming the summit of the cliffs. Coal occurs along the cliffs, but at no locality visited was it of economical importance. The most interesting discovery was that of asphaltum springs, on the southern side of the crest of the Roan Plateau. The mineral tar flows from fissures in Tertiary sandstones and hardens as it pours down the walls of the cañons on which it occurs. About a dozen of these springs were noted, some of them in connection with sulphur springs.

The party, after finishing the northern area, started for Rawlins, on the Union Pacific Railroad, which they reached October 23, having been in the field two months. In that time they traveled about 1,100 miles, locating 55 topographical stations, and surveying 4,000 square miles in about 35 working days, the rest of the time being occupied in marching to and from and between the districts.

The White River division was directed by George B. Chittenden, as topographer, accompanied by Dr. F. M. Endlich, as geologist. The district assigned to this party began on the east at longitude 107° 30′, joining the work previously done, (1874,) and extended westward to longitude 109° 30′, or about 27 miles over the Colorado line into Utah. Its southern boundary was north latitude 39° 38′ or the approximate line of the Book Cliffs, while the White River formed the northern limit. The area surveyed comprised about 3,800 square miles. In working up the topography of this district the party spent 48 days of absolute field-work, made 41 main topographical stations and 16 auxiliary ones, and traveled within the district about 1,000 miles. The country has hitherto been almost entirely unexplored, and had been described by the nearest settlers as a broken cañon country, extremely dry. It was marked on the maps as a high, undulating plateau, with fresh-water lakes and timber. The party saw no lakes of over 400 yards diameter, and but two or three of these, and timber was rather the exception. The country is nearly all inhabitable, both winter and summer, and considerable portions of it are valuable. About three-quarters of it is within the limits of the Ute Indian reservation.

The general topography is a gentle rise from White River toward the south, and a sudden breaking off, when the divide is reached, into rugged and often impassable cliffs, known on the maps as the Roan or Book Mountains. The gentle plateau slope of the White River slope is cut by almost numberless and often deep cañons, and in many cases the surface of the country has been eroded away, leaving broken and most picturesque, the lower benches generally covered with cedars and piñons, and the upper rich in grass. There are four main streams draining into the White, the most eastern of which is a large running stream. The second has in summer no running water for the greater part of its course, although pools of good water may be found in its bed. The third is for the most of its length a mere trickling stream of alkali water; while the fourth and most western one is dry for 25 miles from its mouth and then forks, one branch containing good water in pools, while the other is a running stream of bitter alkali. The trails generally keep on the summits of the ridges to avoid crossing the numerous cañons. Geologically speaking, the district is one of singular uniformity. Traveling westward, the older formations, reaching back as far as the Triassic, were found. These were followed by Cretaceous, which in turn was covered by Tertiary. About three-quarters of the region surveyed is covered with beds, belonging to the latter period, dipping gently from the summit of the Book Cliffs northward. Owing to the lithological characters of the strata, water was a rare luxury in most parts of the district. In the far western portion and outside the limits of the reservation, one large vein of asphaltum and several small veins were found, with, also, running springs of the same material, all of which, if once reached by railroads, will prove of great commercial value. At present, they are about 50 miles from white settlements and 100 miles from the nearest railroad communication. Work was completed October 14, and the party marched eastward through Middle Park to Boulder City, Colo., having been in the field rather more than two months.

The Yampah River division, in charge of Gustavus Bechler, with Prof. C. A. White as geologist, reached the field late in August. The district assigned to the party for exploration is virtually the northwestern corner of Colorado, embracing also a small belt of country lying in Utah. The Bear or Yampah River forms the natural boundary of this area on the north as the White does on the south; both tributaries to the Green and eventually of the great Colorado of the West. Their course in general is westward through the whole extent of the district. The eastern and western limits of the district are the same as those of the White River district, which lies immediately to the south of the Yampah district. Between the two rivers the country is composed for the greater part of plateaus or table-lands, which, according to their elevation, have the features of high plateaus, terraces, benches, and offsets. This belt of country is about fifty miles in width. It is cut by

dry cañons and gorges, with scarcely any grass or timber. From the White River agency, White River takes an almost due west course for about eighteen miles, most of the way through an open valley, with here and there a few narrow gorges. About fifty miles below the agency the valley opens into a broad barren expanse, with scanty vegetation. Soon after the river enters a cañon, the walls of which increase until it flows into the Green.

The Yampah deviates but seldom from a westerly course. Like the White, it flows through a plateau country, which rises gently from the river back for a distance of about eight miles. South of the river are the Williams River Mountains. The Yampah traverses the country more or less in a cañon, occasionally emerging into open grassy valleys. Where the Snake, one of its tributaries, comes in there is a park about 8 miles in length from east to west, surrounded on all sides by eroded terraces and plateau spurs that rise by steps to the divide on either side. Leaving this park, the river enters a huge fissure, and continues in cañon until it joins the Green, in longitude 109° 40′ and latitude 32° N. After the Yampah joins it, the Green also continues in cañon for the greater part of its length. All these rivers have numerous branches from both sides, forming deep cañons the greater part of their length. As a whole, the district is very arid and barren, and almost destitute of trees. The total area surveyed by Mr. Bechler is about 3,000 square miles. The rocks of the district, studied by Dr. White, the eminent palæontologist, embrace all the sedimentary formations yet recognized by the investigators who have studied the region that lies between the Park Range and the Great Salt Lake, viz, from the Uinta quartzite (which underlies the Carboniferous) to the Brown's Park group, or latest Tertiary, inclusive. Much information was also obtained concerning the distribution of the local drift of the region, the extent and geological age of outflows of trap, &c. The brackish-water beds at the base of the Tertiary series, containing the characteristic fossils, were discovered in the valley of the Yampah. They are thus shown to be exactly equivalent with those from the valley of Bether Creek, in Wyoming Territory. The work of the past season shows very clearly the harmonious relations of the various groups of strata over vast areas; that, although there may be a thickening or a thinning out of beds at different points, they can all be correlated from the Missouri River to the Sierra Nevada Basin. Dr. White remarks that the line between the Cretaceous and Tertiary epochs must be drawn somewhere, but that it will be strictly arbitrary, as there is no well-marked physical break to the summit of the Bridger group.

The Zoölogical division was in charge of Dr. Elliott Coues, U. S. A. The party left Cheyenne on the 15th of August, and traveled westward to Laramie Plains and thence southward into and through North Park. From North Park they proceeded to Middle (Egan) Park, and finally returned to Cheyenne via Berthoud's Pass and the plains east of the

mountains. Collections in various departments of zoölogy were made along the whole route traversed, but particularly on and near the Rabbit Ear range of mountains; and careful observations were taken of the various zoölogical phenomena which presented themselves. The collections have been deposited in the National Museum, with the exception of the osteological material, which has been donated to the Army Medical Museum. The material secured will become the basis of Dr. Coues' reports upon the zoölogy of the region explored. In the general field-work the zoölogist in charge was ably assisted by Mr. L. M. Cuthbert, of Washington, and Mr. W. W. Karr, of Memphis.

The Photographic division of the survey did not take the field during 1876, partly on account of the lateness of the season, but also in part because of the accumulation of office-work. Mr. Jackson, the photographer, remained in Washington during the summer engaged in arranging the collection of Indian photographs and preparing material for the publication of a historical and biographical catalogue of photographs of seventy-five tribes of the North American Indians.

The survey, in addition to its field-work, prepared an exhibit for the International Centennial Exhibition. The exhibit was divided into models, maps, photographs, publications, sketches, and pictures in water-colors, and chromos, and specimens. There were two classes of models, one representing geological structure and the other the ancient ruins of Southwestern Colorado and portions of adjacent territories. One of the latter class represents a two-story cliff-house of the Rio Mancos of Colorado. It is built in the crevice of the rock, 800 feet above the valley, in an almost inaccessible situation. Another model represents the ruins of a double-walled tower, a form of building that seems to have been common among the ancient inhabitants of the region. There were also two models of a cave-dwelling of the Rio de Chelly of Northeastern Arizona, one representing the ruins and the other their ideal restoration. The geological and topographical models were as follows: Two of the Elk Mountains, one of them being divided into sections, showing the internal structure of the range, and the other showing only the topography and geology, the latter represented by colors. The maps on exhibition were topographical, geological, and hypsometric. The photographs and positives on glass represented the scenery and ruins of the West and the hot springs of the Yellowstone National Park. Full sets of the reports, with sketches in color of scenery and in crayon of Indians, and also specimens from the Yellowstone hot springs, added to the exhibit.

During 1876 the following publications were issued by the survey:

Bulletins, volume ii, (Nos. 1, 2, 3, and 4,) comprising over 300 pages, with 110 illustrations.

Eighth Annual Report, (Colorado and adjacent territory,) 515 pages and 88 illustrations.

Monograph of the Geometrid Moths, by A. S. Packard, jr., 607 pages and 13 plates.

Invertebrate Paleontology, by F. B. Meek, 629 pages, with 85 woodcuts and 45 plates.

Catalogue of Publications, second edition.

3. *Exploration of the Rocky Mountain Region by Prof. J. W. Powell.*—As soon as the appropriation for the fiscal year of 1876–'77 could be used, the surveying corps left Washington and proceeded to the rendevouz camp at Gunnison, Utah, where the field parties were organized under the general superintendence of Prof. A. H. Thompson, geographer of the expedition. While *en route* they were joined by Capt. Clarence E. Dutton, of the Ordnance Department, U. S. A., who had been assigned for duty on this survey by the Secretary of War, and directed to make an examination of the immense fields of igneous rocks in Southeastern Utah.

The field organization as finally completed differed somewhat from that of previous years—the geographic and geological work being assigned to separate parties, each practically independent in all movements, though working under the same general plan and within the same territorial limits. It is believed that better results can be and have been secured by this separation of distinct branches of the survey than by the old method of attaching a geologist to a geographic party or a geographer to a geological party.

Five parties were organized—one under Prof. A. H. Thompson, to continue the triangulation; one topographic party under Mr. Walter H. Graves, another under Mr. John H. Renshaw; one geological party under Mr. G. K. Gilbert, another under Capt C. E. Dutton.

The party under Professor Thompson continued the expansion of the primary triangulation resting on the base-lines measured in preceding years at Kanab and Gunnison, Utah. The area embraced in this season's work amounts to about 10,000 square miles, the instrument used being a ten-inch theodolite of peculiar construction, designed especially for this work by Professor Thompson.

Topographic party No. 1, in charge of Mr. Graves, extended the secondary triangulation over an area of 6,000 square miles, lying between the Wasatch Mountains on the west, and the Green and Colorado Rivers on the east. Mr. Graves also made a complete plane-table sketch of the country surveyed, which, taken in connection with his angles for locations and perspective profile sketches, will enable him to construct a map of his district on a scale of 4 miles to the inch. The principal topographic characteristics of this region are long lines of unscalable cliffs, the escarped edges of terraced plateaus, of which the country is composed, and deep, narrow cañons with vertical walls, both presenting well-nigh impassable barriers to travel.

The only considerable bodies of irrigable lands found are along the valleys of the Green and San Rafael Rivers. The only timber-lands are on the Sevier plateaus at an elevation of from 8,000 to 11,500 feet.

The work of topographic party No. 2, under Mr. Renshaw, was confined to Southwestern Utah and Southeastern Nevada, one of the most rugged and barren sections in the Great Basin. The methods of survey were the same as adopted by party No. 1, except that perspective profile sketches were made by the aid of the orograph, a newly designed instrument that promises to be of great use in topographic surveying. The work of Mr. Renshaw and his able assistant, Mr. O. D. Wheeler, was extended over about 4,000 square miles. In all this area no considerable bodies of irrigable lands are found; probably not one-half of one per cent. possessing any value except for pasturage.

A topographic survey of the Henry Mountains was made in 1875, and a map constructed on a scale of 4 miles to the inch, but this being thought too small a scale to admit of correct representation of the details of the geology, Mr. Gilbert, in addition to his geological work, made a more detailed survey of the topography, carrying a complete system of secondary triangulation and a connected plane-table sketch over more than 1,000 square miles. The data collected are sufficient to make a topographic map of the Henry Mountains on the scale of 2 miles to the inch, or 1-63000.

The Rocky Mountain Region of the United States, (not including Alaska,) or that portion west of the meridian of 99° 30′, was by a former Secretary of the Interior divided into districts for surveying and mapping purposes, and these districts numbered; the area of each district is $2\frac{1}{2}$ degrees in longitude, and $1\frac{1}{4}$ degrees in latitude. The region of country surveyed by the parties under the direction of Professor Powell is embraced in districts numbered 75, 85, 86, 95, 96, 104, and 105, the first five lying directly west of the region in which Dr. Hayden is engaged, while districts 104 and 105 lie immediately south of the other districts in which he himself has been at work. During the earlier part of his work, before these districts were established by the Department, Professor Powell's work extended in an oblique direction from northeast to southwest along the general course of the Green and Colorado Rivers through the districts above designated, but the work was in such condition that no one district was complete. During the present season his parties have been engaged in extending the survey over the unsurveyed fractional districts, so that final and complete maps of each may be constructed.

The methods of survey during the present season are essentially the same as those employed during the last, being modified to a slight extent as experience has suggested; the chief improvements are in the method of triangulation. In addition to the determination of geodetic positions and general geographic features, the system of classifying the lands inaugurated in former years has been continued during the present, the object of this classification being to determine the extent and position of the irrigable lands, timber lands, grass lands, mineral lands, and waste lands; the latter being composed of rugged mountains and

desert plains. The practical importance of this classification, if carefully made, is great, not only in presenting the information desirable to those who wish to settle in the country, but also in the collection of facts neccessary to intelligent legislation concerning these lands.

In the region embraced in this survey a very small portion of the country can be redeemed by irrigation for agriculture, and no part of it can be cultivated without irrigation. It appears from the reports that less than one per cent. can be thus made available. Especial care has been given to the determination of the extent of such lands, so as to exhibit their position on the maps. These irrigable lands and timber lands, together with some small districts of coal-bearing lands, are the only parts of the country that should be surveyed into townships and sections.

Having in view economy and convenience in the linear surveys of this district, the geodetic points of the general geographic survey under the direction of Professor Powell have been carefully marked, that they may hereafter be used as datum points by the officers of the General Land Office.

Extensive coal-fields exist in the region surveyed, but, as in many other parts of the world, these coal-fields are of practical value at comparatively few places. The general characteristics of these coal-fields have been the subject of much investigation, and some very interesting and valuable results have been reached; these will appear in the final reports. The quantity of available coal is practically inexhaustible, and the mines that can be economically worked are of great number.

In the Uinta Mountains silver and copper mines have been discovered and worked by private parties. The extent of these silver and copper bearing rocks has been determined, but their value can be established only by extensive working.

Mr. G. K. Gilbert devoted much of his time to the study of the structure of the Henry Mountains, of which enough had been learned in the preceding season to warrant the belief that they embodied a type of eruption hitherto unknown. The attention given to them has been amply repaid by the elucidation of the manner of their constitution. They are volcanic, but their lavas, instead of finding vent at the surface of the ground and piling up conical mountains thereupon in the usual manner, ceased to rise while still several thousands of feet underground, and lifted the superincumbent strata, so as to make for themselves deep-seated subterranean reservoirs, within which they congealed. Over each of these reservoirs the strata were arched and a hill or mountain was lifted equal in magnitude to that which would have been formed if the lava had risen to the surface; but the material of the hill was sandstone and shale instead of hard volcanic rock. Subsequent erosion has carried away more or less completely the arching strata and laid bare many of the intrusive masses. It has revealed also a system of reticulating dikes which go forth in all directions from the main masses, inter-

secting the sedimentary rocks. The lava masses, the dikes, and those portions of shale and sandstone which have been metamorphosed by contact with the molten rock, are harder than the unaltered sedimentary strata which surround them, and yield to the agents of erosion more slowly. The wash of rain and streams by which the face of the surrounding country has been degraded, has been resisted by these hard cores, and in virtue of their obduracy we have the Henry Mountains. The deposits of lava are not all in juxtaposition but are scattered in clusters, and each cluster has created a mountain. Mount Ellen consists of a score of individual lava masses; Mount Pennell and Mount Hillers of one principal mass, accompanied by several of minor importance; Mount Holmes of two masses; Mount Ellsworth of a single one, with many dikes and sheets. Each of the mountains is individual, topographically as well as structurally, and together they constitute a group of mountains, not a range. Mr. Gilbert's note-books contain many sketches, by the aid of which he will be able to illustrate all the features of the peculiar types of structure.

Before commencing the main work of the season, Mr. Gilbert made an excursion in search of the outlet of Lake Bonneville, the great fossil lake of Utah. During an epoch which was probably coincident with the glacial epoch, the broad interior basin of Utah was covered by a great lake which overflowed its rim and sent an outlet to the ocean by way of the Columbia River. When the climate became gradually warmer and drier, the evaporation grew greater and the rain-fall grew less, until finally the overflow ceased and the lake began to dry away and shrink within its shores; to-day only Great Salt Lake and Sevier Lake remain, but high up on the mountain is carved the Bonneville Beach, a permanent record of the old flood-tide. The search for the point of outlet was successful, and it was found at the north end of Cache Valley, a few miles beyond the boundary of Utah, in the Territory of Idaho. The bed of the outflowing stream was traced for a number of miles. The beach-lines were seen to run quite to the pass through which the channel was cut, but beyond, on the side of the drainage of the Columbia, no trace of them could be seen.

Of no less interest was the discovery of a recent orographic movement at the western base of the Wasatch Range. A great fault runs along that base; one of the faults by which the mountains were produced. The block of the earth's crust which lies to the westward of the fault-planes was dropped down, and the block which lies to the eastward was lifted up, and from the eastward block subsequent erosion has carved the range. Along the plane of ancient movement there has been a recent movement. The mountain has risen a little higher or the valley floor has dropped a little lower, and this so recently that the Bonneville flood is ancient in comparison.

Capt. C. E. Dutton resumed this year his study of the large area of igneous rocks in Southern Utah, in the vicinity of the Sevier River,

and has brought back additional information which he purposes employing in the preparation of a monograph of the entire tract. He has worked out the structure of the component features, and the approximate area of the eruptions, and is engaged in classifying the various lithologic members. The older outbreaks appear to be of early Tertiary age, (Eocene,) and to have been nearly continuous through a long period. The volcanic beds thus formed were subsequently traversed by great faults, and tables were uplifted, with deep valleys between them; the structure thus produced conforming to the general type prevalent throughout the plateau country. The degradation of these long lofty tables gave rise to conglomerate beds of great extent and thickness, which are composed entirely of volcanic materials. Captain Dutton has compared the details and arrangement of these conglomerates with the alluvial beds now accumulating in great volume in the valleys out of the waste of the adjoining tables, and finds an agreement between them so close that he ascribes the same mode of origin to both. He also finds considerable metamorphism not only in the underlying sedimentary beds (early Tertiary) but in the superposed conglomerate; and he thinks it must have occurred comparatively near the surface. The greater portion by far of the erupted rocks he classes as trachytes and trachydolerites. The rhyolitic varieties are of very limited occurrence, being found only in the vicinity of the Beaver or Tunbar Range. In the southwestern part of the field (near Panguitch) extensive fields of basalt are found. Captain Dutton distinguishes two ages of the basalt; one prior to the development of the present structural features of the region, the other subsequent to it—the former being more properly dolerite or anamesite, the latter typical basalt.

Under instructions from the Interior Department, Professor Powell and his parties have also been engaged in general ethnographic work in the Rocky Mountain Region. One of the special items in these instructions was the classification of the Indian tribes, such classification being not only of scientific interest, but of great importance in the administration of Indian affairs. For the eastern portion of the United States this work had been accomplished—first by the unofficial labors of the Hon. Albert Gallatin, and subsequently by the Hon. Henry R. Schoolcraft, as an officer of the Government; and some addition had been made to the work by various persons for scientific purposes. This work has been renewed by Professor Powell, and has been pushed with all the energy possible with the funds at his command, and a large amount of material has been collected by himself and by members of his corps, and by residents in and travelers through the country. In addition to this a large amount had been collected by the Smithsonian Institution through various channels—materials as yet unpublished. That Institution has placed all this matter in the hands of Professor Powell to be combined with his own collections. The first volume of the reports on this subject will soon be issued. It treats of

the tribes of Alaska, the western half of Washington Territory, and Northwestern Oregon, and is accompanied by maps exhibiting the geographic distribution of the tribes of these regions. A second volume on the tribes of California has also been sent to the Government Printer, which will be succeeded by others as rapidly as they can be prepared.

Dr. Elliott Coues, U. S. A., is engaged on a "Report on the Birds of the Valley of the Colorado," based primarily on the collections made by the several parties under Professor Powell's direction. This report was sent to the Government Printer early in the spring, and about 200 pages have already been set up.

Mr. L. F. Ward, the botanist of the corps, assisted by several gentlemen of scientific ability in this department, has been engaged during the entire year in the preparation of a "Report on the Botany of the Valley of the Colorado," which is now nearly ready for publication.

CONCLUSION.

From the foregoing report I trust it will be evident to all interested in the prosperity of the Institution that the establishment is still successfully prosecuting the plan best adapted to realize the intentions of its founder, that its funds are in a good condition, and that its reputation and usefulness have suffered no diminution since the date of the last report.

Respectfully submitted.

JOSEPH HENRY,
Secretary Smithsonian Institution.

WASHINGTON, *January*, 1877.

APPENDIX TO THE REPORT OF THE SECRETARY.

REPORT OF PROFESSOR BAIRD ON THE CENTENNIAL EXHIBITION OF 1876.

SMITHSONIAN INSTITUTION,
Washington, January, 1877.

SIR: I beg leave to present a statement of operations for 1876 connected with the Smithsonian department of the United States Centennial exhibit, in continuation of that given in the annual report of the Smithsonian Institution for the year 1876.

At the end of the year 1875 the preparations for the exhibit referred to were in full operation, involving a great deal of arduous labor, for the purpose of having everything in readiness by the 10th of May, the date of the opening of the International Exhibition.

As originally authorized by you, the display to be made by the Smithsonian Institution was to include, first, the mineral resources of the United States; second, its animal products; and third, its ethnology.

The superintendence of the mineral section was intrusted to Prof. William P. Blake, of New Haven, a gentleman of much experience in such labors and familiarly acquainted with the mining industries of the United States generally. By visiting different localities, especially in Michigan, Missouri, and elsewhere, and by the efforts of several assistants, among them Mr. Charles M. Shepard, Mr. Howe, Professor Brodhead, and Professor Hitchcock, supplemented by an extensive and laborious correspondence, he succeeded in securing for the Institution a very full display of ores, building-stones, clays, &c.

The arrangement made with Mr. Thomas Donaldson to gather a full series of the ores of the precious metals of gold, silver and mercury from the Western States and Territories also continued to be highly productive, Mr. Donaldson personally visiting a great number of mining localities, and obtaining a full series of specimens, many of them rich in bullion and thus of very considerable commercial value.

In no case was either he or Professor Blake called upon to pay money for any article, no matter what its intrinsic value, the specimens being contributed by the owners of the mines with the understanding only that they were to receive a suitable display in the Government exhibit and subsequently in the National Museum in Washington.

Most of the material of these collections was sent directly to Philadelphia, only one of at least thirty car-loads of mineral matters being shipped from Washington.

In addition to the objects just referred to, arrangements were effected

with several State commissioners for the exhibition in the Smithsonian mineral department of collections made by them to illustrate the resources of their several States, and which were delivered in the building free of cost and for the most part provided with the necessary cases and without expense to the Centennial fund. Chief among these was the exhibit of the State of Nevada, which was of very great extent and made under the supervision of Mr. Whitehill, the State geologist.

A collection from Montana, made under the direction of Mr. Woolman, came next in interest and importance. General Wilder presented a series of the ores and building-stones of Tennessee in great variety, and Mr. Joseph Wharton furnished a large quantity of raw material and finished products connected with the nickel industry. Under the supervision of Dr. E. R. Beadle, Dr. Koenig, and Mr. Wilcox, a very valuable loan collection of the principal minerals of the United States formed part of the Smithsonian exhibit.

The animal division was under the special charge of Mr. G. Brown Goode and included the subject of the fisheries of the United States, for which special provision was made in the congressional appropriation.

Mr. Goode prepared, with great labor, a classification of the objects necessary to constitute such an exhibition, which was printed by the Interior Department as No. 6 of the Bulletins of the National Museum and widely circulated.

In addition to the objects purchased or presented to this series, several very valuable collections were lent by various parties. Among them may be mentioned a great variety of nets by the American Net and Twine Company of Boston; an extensive series of apparatus used by the angler, by Messrs. Bradford & Anthony, of Boston; of North American furs, by Messrs. Charles Herpich & Co., of New York; polished Unio shells from Dr. Miller and Mr. Schaffer, of Cincinnati, &c.

Here, as in the case of the minerals, the donations and loans were so numerous as to render it impossible to mention them in a brief report like the present.

The ethnological exhibit was made under the auspices of the Indian Bureau of the Interior Department, the funds necessary for the purpose being supplied from its share of the Centennial appropriation.

The preparation for the exhibition and the arrangement of the collection were under the direction of Dr. Charles Rau, assisted by Mr. F. H. Cushing. The collections in the field were made by Messrs. James G. Swan, in Alaska and Washington Territory; by Mr. Stephen Powers, in California and adjacent States; by Major J. W. Powell, in Arizona, Utah, and Colorado; by Messrs. Stephen Bowers and Paul Schumacher, on the coast of the Pacific and California.

A large number of loans, especially of stone implements, &c., were

made by various gentlemen throughout the country, who were interested in rendering this portion of the general exhibit complete.

The Government building was completed and turned over to the executive board on the 1st of March, although the Smithsonian division was occupied by Professor Blake prior to this with a portion of the mineral display.

The shipments to Philadelphia from Washington began on the 20th of April, and a very large force was necessarily engaged for a time in the Government building in putting up the cases, for the most part manufactured in Washington, and in unpacking and arranging the collections. The contents of eighteen cars were loaded in Washington, forwarded to Philadelphia, and unpacked, between the 20th of April and the 1st of May, several car-loads following in the latter month. The total number of car-loads sent from Washington amounted to twenty-two, while nearly forty full or partly full loads were sent from other directions, principally containing minerals.

In arranging the various specimens in the Government building, Professor Blake, for the mineral section, was assisted by Mr. Donaldson, Mr. Adams, Mr. Thompson, and, for a time, by Mr. Draper.

The animal and fishery sections were placed in order by Mr. Goode, aided by Messrs. Chester and Brown, and the ethnological by Dr. Rau, assisted by Mr. Cushing; all the departments having many laborers and other assistants.

On the 10th of May, the opening day of the International Exhibition, the greater part of the Smithsonian and Fish Commission collections was in place, although still requiring some subordinate arrangement; and it may here be stated, generally, that the Government exhibit was far more nearly ready on that day than any other in the Centennial Exhibition—those of the War and Navy Departments being entirely in order. By the 1st of June, all the collections of the Institution were in place, the specimens labeled and everything in satisfactory condition.

In obedience to your instructions, I left Washington on the 31st of May, to take direct charge of all the branches of the Smithsonian and Fish Commission divisions, assisted in their respective sections by Messrs. Blake, Goode, and Rau. Mr. Goode, however, was unfortunately soon obliged to leave, in consequence of the illness caused by overexertion, and his place was not supplied.

Numerous collections of various kinds were added throughout the season of the exhibition, partly in continuation of the special researches instituted by the Smithsonian Institution and the Indian Bureau, and partly by individual contributions. A very attractive feature of the Fish Commission section was a succession of fresh fish, supplied by Mr. E. G. Blackford, the well-known fish-dealer of Fulton Market, New York, who made special arrangements to secure all the varieties of American food-fishes, sending them in ice to the Government building and delivering them there without any charge whatever. Here they were

shown in two immense refrigerators—one contributed by Mr. Alegretti and one by Mr. Banta, each having its peculiarities. Here were exhibited day by day not fewer than two hundred varieties of American fishes. Some of the fish were kept on exhibition in a frozen condition during the entire period of the Centennial display.

My own work I found very arduous, in consequence of the large amount of correspondence, the number and complexity of accounts, and the constant stream of visitors. To this was added service on two of the groups of judges—one that of the fisheries and the other the supplementary group, instituted toward the close of the exhibition, to take cognizance of exhibits which claimed consideration for award from having been overlooked when the first series of judges prosecuted their labors.

It may be readily imagined that, however arduous the duties of the position assigned me at the Centennial, the associations were extremely agreeable, in view of the large number of intelligent and scientific men among the judges, both American and foreign, and the gentlemen connected with the several commissions with whom I was brought in contact. The relations to the United States Centennial Commission were also extremely pleasant, the director-general, the president, and the officials generally doing all in their power to facilitate the labors of the Government board.

It is with much satisfaction that the members of the executive board have been able to report to their respective chiefs the fact that the collective exhibition made by the Government, under their charge, was considered the most satisfactory and instructive display of all those shown at the International Exhibition, both as respects extent and variety, and the thoroughly systematic and convenient arrangement and labeling of the collections. A printed catalogue was contemplated and the manuscript for the same prepared, but the Centennial appropriation would not admit of the cost. An application was therefore made to Congress for an order to print this catalogue, but failed to receive consideration in the closing hours of the session.

The exhibition closed on the 10th of November, in accordance with the original plan, or in six months from its opening, and, as is known to every one, it continued to increase in interest until the final day. The unusual heat of the summer deterred many persons from visiting it at that season; but with the cooler weather of the late summer and autumn the throng was immense, and the general result, both as to the number of visitors and the receipts, was unexampled in the history of similar exhibitions.

Some time before the close of the exhibition intimations had been made by numerous exhibitors, both foreign and domestic, of a design to make various donations of material to the United States; but the exact magnitude of these accessions to the collections displayed was far from being anticipated. As it proved, not only did many private individuals contribute their collections to a greater or less extent, but objects from the exhibits of various States were presented, notably from those of Michi-

gan, Ohio, Indiana, Tennessee, &c., in addition to the collections from Nevada, Utah, and Montana, already mentioned as included in the Government series. It was, however, by foreign nations that the most important donations were made, their commissioners, with few exceptions, presenting either the whole or a large part of their animal-, vegetable-, and mineral-, and to a considerable extent their industrial exhibits. An accompanying list expresses in general terms the character of the objects received from the different parties, but no adequate idea can be formed of the whole until the collection is re-arranged in a suitable building in Washington.

The suggestion of the President of the United States that acknowledgment be tendered by Congress to the foreign commissions which have made such remarkable donations to the people of this country is one eminently worthy of consideration.

No provision was made by Congress for the reception of the new material referred to, beyond an appropriation, to the Smithsonian Institution, for the repair and fitting up of the Armory building to receive them in Washington; and as the Institution is only required to take charge of "objects of nature and art, of foreign and curious research, of natural history, mineralogy and geology belonging to the United States," *when the same shall be "in the city of Washington,"* it was a matter for consideration to what extent it would be proper to use the funds appropriated by Congress for the Centennial Exhibition in receiving and taking charge of such objects.

In view of their relation in most cases to subjects covered by the Smithsonian exhibit and of the manifest discourtesy of rejecting and refusing to receive such articles, I asked and obtained your permission to take charge of them, and immediately set to work a large force in transferring them from the various buildings to the Government building. This force was engaged in the transfer almost uninterruptedly from the 10th of November, the closing day of the exhibition, until the middle of February. The expenses of cartage alone to the Government building exceeded a thousand dollars, some of the specimens being of great magnitude and weighing several tons.

Simultaneously with the employment of the transfer parties, another force was occupied in packing the collections in preparation for shipment, the additions thus made being estimated to require from forty to sixty freight-cars for their accommodation.

Reference has already been made to the expressions of interest in the Government exhibit and in its transfer in bulk to Washington and reproduction there. This idea was broached at an early period and its importance urged by many influential newspapers.

The National Academy of Sciences at its meeting in October directed its president to memorialize the President of the United States on this subject, and, this having been done, His Excellency directed that all oper-

ations looking toward the transfer of the collections to Washington be suspended until Congress might take such action as it deemed proper in regard to the subject. This order was subsequently modified by allowing the removal to Washington of such objects as were needed for the use of the Departments and all such specimens as were liable to be injured by the cold and dampness which prevailed throughout the building after the 10th of November.

In view of the fact that the building, having been sold, was deliverable to the purchaser on the 1st of March, on the 19th of January, 1877, a final order was issued by the President directing the transfer of all the articles to Washington, there to be stored in some suitable place or places, pending congressional action.

I remained in direct charge of the operations of receiving, packing, &c., until the 9th of December, when, in obedience to your instructions, I returned to Washington and left Mr. Daniel Leech, of the Smithsonian Institution, to direct future operations, assisted by Messrs. Chester and Brown, the mineral collection still remaining under Professor Blake's special administration. These gentlemen have been diligently occupied in the interval in packing the objects and in forwarding them to Washington as fast as suitable cars could be obtained, and it is expected that the entire series will be in Washington by the 10th of February.

It was extremely fortunate that Congress gave to the Institution the use of the armory building, an edifice 100 by 50 feet in dimensions, and with four floors, of 5,000 square feet each, as without it it would have been entirely impossible to provide for one-fourth of the collection. It was intended originally that the armory should serve as a supplement to the Smithsonian building by exhibiting on two of its floors the fishery and mineral collections, but it was soon found that any idea of a display there must be abandoned and the building used exclusively for the storage of objects in boxes. It is now being rapidly filled on all its floors in this way, and any attempt at an exhibition of its contents must be deferred until a suitable building can be constructed for the purpose.

An extension of the National Museum by the construction of additional wings, or other buildings, in connection with the Smithsonian edifice has long been in contemplation, as for many years it has been impossible to show many of the most interesting objects belonging to the United States for want of suitable space. The Centennial collections, however, being added to the former stock, has precipitated the crisis in this respect and rendered it necessary that some special arrangement be made at an early day for the accommodation of the entire series.

The entire capacity of the Smithsonian building is now 25,000 feet of floor space. The collections exhibited by the Institution at the Centennial, covered about 34,000 feet of floor. The donations at the close of the exhibition will certainly require 24,000 feet, while articles stored in the basement, and never shown at all, call for at least 20,000 feet.

It is thought, however, that these additional collections may be condensed into a space of, perhaps, 50,000 feet, although the aggregate space already mentioned would be much better suited to the exigencies of the case, and it is therefore to be hoped that Congress will, at an early day, take action in reference to a new building, which, of course, will be most conveniently placed in connection with the Smithsonian edifice.

This should be constructed as cheaply as possible, consistent with the demand for space and protection against the elements and fire. It is thought that by laying a concrete floor on the ground, using brick walls and piers and a roof with iron beams, and wooden sheathing covered with tin, these requirements will be most readily met. Several plans have been proposed for this building, some one of which it is hoped will find favor and be adopted.

In a series of accompanying papers, I beg to present a general account of the Government exhibit, a statement of the contributions from foreign governments, and a separate list of the more important contributions of mineral objects from American sources.

The alphabetical list of contributions to the National Museum for the year 1876, will also show the many smaller donations that have been made to its several departments.

I have the honor to be, very respectfully,

SPENCER F. BAIRD,

Representative of the Smithsonian Institution and of the Department of Food-Fishes in the Government Centennial Board.

Professor JOSEPH HENRY,

Secretary Smithsonian Institution.

GENERAL ACCOUNT OF THE GOVERNMENT CENTENNIAL EXHIBIT; BY PROFESSOR BAIRD.

Appropriations by Congress in acts of March 3, 1875, and July 19, 1876.

	March 3, 1875.	July 19, 1876.	Total.
War Department	$133,000	$18,500	$151,500
Navy Department	100,000	.....	100,000
Interior Department	115,000	15,000	130,000
Treasury Department	5,000	14,000	19,000
Post-Office Department	5,000	.....	5,000
Agricultural Department	50,000	.....	50,000
Smithsonian Institution	67,000	21,000	88,000
United States Commission of Food-Fishes	5,000	5,000	10,000
For show-cases, shelving, stationery, &c	25,000	.....	25,000
	505,000	73,500	578,500

PREPARATION FOR THE EXHIBITION.

Erection of building.—A committee of the board of the respective Departments, was appointed to take into consideration all the matters relating to this building, and to consider plans for the same; and from several offered them, that of an edifice in the form of a cross, designed by James H. Windrim, of Philadelphia, was selected. The floor of this occupied 102,840 square feet, of which 20,840 was taken up by passages, leaving a space remaining of 82,000 square feet for exhibition purposes. It was completed and ready for occupation March 1, 1876, on which date it was accepted by the board. The space assigned to each Department was as follows:

	Feet.
War Department	11,200
Navy Department	10,400
Treasury Department	3,000
Post-Office Department	3,800
Interior Department	20,600
Agricultural Department	6,000
Smithsonian Institution	20,600
Fish Commission	6,000
	81,600

The original contract for the cost of this building was $67,201.61, but subsequent changes somewhat increased the amount. These, with other expenses, such as grading the grounds, &c., made the total amount to be deducted from the available fund, and divided *pro rata* among the various Departments, with the exception of the Treasury and the Commission of Food-Fishes, about $94,000, leaving about $411,000 for the actual purposes of the display.

The building was entirely of wood, and of course liable to damage from fire. A careful guard was, however, maintained, and no accident of any kind occurred during the exhibition.

EXHIBIT AS MADE.

Completeness on opening-day.—Although the time at the command of the board for the preparation of the exhibit was short, and the amount of money appropriated to carry out the plans of the several departments was considered by them insufficient for the purpose, on the opening-day of the exhibition most of the articles were in their places, this being especially the case with those of the Army and Navy; and the remainder were ready within the course of a few weeks later. In this respect the Government display was in advance of those in the other buildings, the internal arrangements of which were more or less incomplete for a long time after the 10th of May.

Summary of exhibits in the different sections.—The collections, as finally arranged, consisted essentially of the following elements:

A.—*The War Department.*

1. *The Signal-Service Bureau.*—In this was shown the apparatus of the Signal-Office proper, with its field telegraph and wagons, instruments, &c., and that of the weather-observation division, with its self-registering and other meteorological apparatus. Here observations were made and recorded, and a copy of the daily weather bulletin posted.

2. *The Ordnance Bureau.*—Here were shown all the machinery, in working operation, for the manufacture of cartridges and of the Springfield rifle, together with a series of models of ordnance of different patterns, shot, shell, &c., and outside the principal building was a laboratory for illustrating the methods of testing ordnance and powder.

3. *The Quartermaster's Department.*—This displayed specimens of the uniforms of soldiers at different periods in the history of the American Army, the horse-equipments, tents, blankets, &c., as also a veterinary display illustrating the diseases of horses' feet.

4. *The Engineer Bureau.*—Here were shown models of river and harbor improvements, including that of the excavation at Hell Gate, samples of maps and charts issued by the bureau, &c.

5. *The Medical Department.*—The exhibit of this department of the Army consisted of a model hospital of the size and equipment of those of usual construction at military posts. Here were the appliances used for keeping and transporting sick and wounded on land and water, the medicines used in the Army, surgical apparatus, and photographs and engravings illustrating the surgical history of the Army, &c.

B.—*The Navy Department.*

1. *Navy Ordnance Bureau.*—In this section were exhibited the different large and small arms used by the Navy at present and in the past, illustrations of the torpedo system, &c.

2. *Bureau of Steam-Engineering.*—This embraced specimens of the different forms of engines used in naval vessels.

3. *The Bureau of Construction and Repair.*—This exhibit included two large working models of the Antietam, one fifty feet long, and serving as a trial-ship for the cadets at Annapolis; also a model of a newly-constructed monitor, and a full-sized monitor-turret, with its guns, was displayed outside of the building.

4. *Bureau of Yards and Docks.*—This showed various models of the different dry-docks belonging to the United States Navy.

5. *Bureau of Medicine and Surgery.*—This presented an exhibition of the various drugs, medicines, food, &c., as prepared for use on ship-board, together with all the equipments of naval hospitals, models of hospital-ships, &c.

6. *Bureau of Equipment.*—Here was shown ships' galleys, boat-stores, uniforms of the Navy in different periods of its history, specimens of rope, bunting, signals, and various patterns and forms of flags.

7. *Bureau of Hydrography.*—The most interesting portions of this was the collection of articles illustrating the various polar explorations of Kane, Hayes, and Hall; also specimens of charts prepared by the Hydrographic Office, compasses, sounding apparatus, and the apparatus used in the observations of the transit of Venus by the American parties.

C.—*Treasury Department.*

1. *The United States Coast Survey, and Bureau of Weights and Measures.*—In this were shown a series of the weights and measures of the United States, and the very complete apparatus used in the measurement of base-lines for surveys. A series of the reports of the office, and of its maps and charts, was also displayed.

2. *Light-House Board.*—In this were shown the different lanterns used for purposes of illumination; the different oils, wicks, &c.; models of light-houses, light-ships, &c. Outside of the building was erected an actual light-house, in full working order, and lighted every night; as also a fog-trumpet or syren of enormous power, capable of being heard at a distance of many miles. This was used to indicate the time daily for the opening and closing of the Centennial Exhibition.

3. *Revenue Bureau.*—In this were shown the specimens of all the forms of revenue-stamps, and the apparatus used in gauging, &c.

4. *Bureau of the Supervising Architect of the Treasury.*—In this, models of various public buildings were shown.

Specimens of United States currency, bank-notes, &c., were also shown by the Treasury Department, as also a complete life-saving station, with boats, &c.

D.—*Post-Office Department.*

In this portion of the building was held the Centennial branch of the Philadelphia post-office, fully meeting the needs of the Centennial Exhibition, and kept up several weeks after the close. Here were seen in operation machines for making stamped envelopes, samples of locks, bags, &c., and two first-class railway postal cars.

E.—*Department of the Interior.*

1. *Bureau of Education.*—In this division were shown models of school-houses from different parts of the country and different periods in our history; school-furniture; apparatus for educational purposes; samples of school-drawing and articles used in object-teaching; illustrations of the progress of the Indian tribes in education and civilization.

2. *Census Bureau.*—This presented the original schedules of the census of 1790, 1840, and 1870, illustrating the progress of the country by the comparative magnitude of the records.

3. *The Patent-Office.*—In this was shown a selection of models from the Patent-Office, illustrating the more important stages of develop-

ment in the industrial and economical arts from the beginning of the Patent-Office system to the present day, as also a complete set of publications of the office.

In connection with this display were arrangements for illustrating the actual methods by which patents are issued in the United States, from the first application for the purpose to its entire completion. In the Patent-Office section were also shown a variety of historical relics, including articles of clothing once owned by Washington, as well as his camp furniture and equipage.

4. *The General Land-Office* exhibited its series of maps, especially one of very large size, constructed expressly for the purpose, and showing the present condition of the land-office system over the whole United States.

5. *The Indian Bureau.*—This display, which was made in co-operation with the Smithsonian Institution, contained illustrations of the aboriginal inhabitants of the United States, both ancient and modern; specimens of their stone implements and pottery; their weapons and domestic utensils; their ornaments and articles of religious observance, &c.

6. *Pension Office.*

7. *Geological Surveys of the Territories.*—Here were exhibited models in relief of areas of the western country, and of ancient ruins, transparent and other photographs of scenery, antiquities, and Indians, books, maps, charts, &c.

F.—*Department of Agriculture.*

1. *Chemical section.*—In this were shown the soils, rocks, marls, fertilizers, agricultural products and their derivatives, samples of food, such as flour, sugar, &c., products of dry distillation of wood, preparations of oils, &c.

2. *Natural-history section.*—This exhibited birds, insects, and other animals injurious or beneficial to the farmer, and included a series of 300 engraved plates to illustrate a work on the economical entomology of the United States; also models of different fruits and vegetables, and sections of 400 species of North American woods, with their leaves and fruits, as well as a series of vegetable fibers, with their applications.

3. *Statistical section.*—In this were shown charts and maps of the farm-lands, the distribution of forests, and the regions suitable for the cultivation of various staples. There were also many engravings of agricultural colleges, &c.

G.—*The Smithsonian Institution.*

This illustrated, first, the operations of the Institution itself; second, that of the National Museum of the United States under its charge.

1. *The Smithsonian Institution.*—This display contained a full series of all the publications of the Institution and charts illustrating its system of international exchanges, with a set of large charts, showing the mean temperature and the rain-fall in the United States.

2. *National Museum, under the direction of the Smithsonian Institution.*—In the museum section were shown collections illustrating the economical mineral wealth of the United States, in a series of ores of the precious and baser metals and their metallurgy, including specimens of the metals and their simple applications; the materials used in the manufacture of glass, such as sand, soda, &c.; and the earth and clays, with their applications in tiles, terra-cotta, bricks, and pottery; the different varieties of coal, petroleum; samples of the principal building stones, as marble, granite, &c.

The animal section contained, first, representations of the animals of the United States of economical importance to the country, as furnishing food, ivory, bone, leather, glue, furs, bristles, oil, &c.; second, the apparatus by which these animals are pursued and captured; third, the means by which they are utilized for the wants or luxuries of man when taken; fourth, specimens of the products of such utilization and their simple applications; and, fifth, the methods by which they are protected and multiplied.

H.—*The United States Fish Commission.*

In this was shown a series of models in plaster or *papier-maché* of the principal fishes and cretaceans of the United States, and photographs and original drawings of the same, as furnishing oil, bone or manure, together with the apparatus of pursuits and capture; models of boats of different styles of construction, and special illustrations of the whale-fishery. Also the methods of fish-culture, in illustrations of hatching-boxes, carrying-vessels, models of fish-ways, &c. This display and that of the animal department of the Smithsonian exhibit were more or less united, and illustrated not only the methods and appliances of civilized man in this connection, but also those of the American savage.

Public opinion in regard to the Government exhibit.—As already remarked, the officers in charge of the Government exhibit were unable to make it as complete as they had hoped, on account of the reduced appropriation for the purpose; but as it was, it was considered by all visitors as decidedly the best part of the International Exhibition, in view of the extent and exhaustiveness of the collection and the method and order of its display.

No special catalogue of the Government exhibits was printed, authority not having been obtained from Congress for the purpose, although a very full catalogue had been prepared.

The building was constantly the resort of intelligent visitors from all parts of the world, and a great many critical reports have been published already in foreign journals in regard to this display. Professor Archer, one of the chief commissioners from Great Britain, in a lecture recently delivered before the Society of Arts in London, uses the following language, in speaking of the United States Government building and its annexes:

"This group consisted of a very large edifice, in the form of a cross, erected by the United States Government at a cost of $60,000, and, in addition, a laboratory, for illustrations of arsenal work, and a model military hospital, which was of great practical utility during the exhibition. Within the chief building was displayed most interesting and instructive collections, illustrative of the work of the Smithsonian Institution, and the general and geological surveys of the States, the mineral, zoological, and botanical collections connected with those surveys, and also most important ethnological and prehistoric collections. The great collection of food-fishes of America, made for the fishery commission by Professor Baird, with the appliances for catching and preserving fish; also series illustrating the various naval and military weapons and engines, and machinery for arsenal work; and, lastly, a complete display of all the applications in the postal department of the States. The general arrangement of the contents of this large building, covering about two acres, was most satisfactory, and had been carried out under the most competent scientific supervision; hence it was felt to be the most instructive portion of the Centennial Exhibition. It brought into full view a great mass of the intellectual work of some of the greatest of American workers in the fields of science."—*Journal of the Society of Arts, December* 22, 1876.

These suggestions were based upon the exhibit as actually made and which closed with the expiration of the Centennial Exhibition, on the 10th of November.

DONATIONS TO THE UNITED STATES GOVERNMENT

After the close of the Exhibition a new element was introduced into the question of the transfer of the Government collections to Washington and their arrangement for inspection and study, namely, the donation to the United States of many objects or entire collections, that had been displayed elsewhere in the Exhibition than in the Government building. These were derived from two sources:

1st. From American State commissions and private exhibitors, by whom much material of great value was presented and tending to fill up important blanks.

2d. From the commissions of the several foreign governments participating in the International Exhibition of 1876.

The experience of previous expositions had indicated the probability of contributions from the latter source, and to meet the expected emergency Congress at its last session granted the Armory building to the National Museum, and made an appropriation for the purpose in the following words:

"For repairing and fitting up the so-called Armory building, on the mall, between Sixth and Seventh streets, and to enable the Smithsonian Institution to store therein, and to take care of specimens of the extensive series of the ores of the precious metals, marbles,

coals, and numerous objects of natural history now on exhibition in Philadelphia, including [any] other articles of practical and economical value, presented by various foreign governments to the National Museum, four thousand five hundred dollars: *Provided*, That the said sum shall be expended under the direction of the Smithsonian Institution."

The contributions from the States were of very great value; Nevada, Utah, Montana, Tennessee, &c., presenting most valuable series of their ores, while an aggregate of much magnitude was received from individuals; minerals, metals, ores, building-stones, coals, pottery, &c., all being included. It was, however, from the foreign commissions as above referred to that the greatest mass was derived, so that, although the gift of some articles was anticipated, the members of the Government board were not prepared for the wholesale donation of by far the greatest portion of the collective exhibits made by foreign nations, as well as those of many of their individual exhibitors. Among these may be mentioned specimens of mining and metallurgy, ores, metals, combustibles, building-stones, earths, clays, tiles, terra-cotta, and pottery; vegetable products, as samples of woods, fibers, seeds, medicinal plants, &c., furs, skins, gelatine, samples of industrial products in the way of woven and plaited fabrics, objects in metal, wood, glass, earthen wares, illustrations of manners and customs, &c.

List of countries from which donations were received.—The nations from which were received the collections in question are the following:

Argentine Republic.
Austria.
Africa, (Orange Free State.)
Belgium.
Brazil.
Chili.
China.
Egypt.
France.
German Empire.
Hawaiian Islands.
Japanese Empire.
Mexico.
Netherlands.
Norway.
Peru.
Portugal.
Russia.
Spain.
Philippine Islands.
Sweden.
Switzerland.
Tunis.
Turkey.
United Kingdom and Colonies.
Bermuda.
Canada.
New South Wales.
New Zealand.
Queensland.
South Australia.
Tasmania.
Victoria.
Venezuela.

The commissions which are not included in this list had nothing at their disposal, their exhibitions consisting either purely of private material reclaimed or otherwise disposed of by their owners, or, as in the case of several British colonies, of articles borrowed from the colonial museum in London and necessarily returned there.

Assignment of collections received.—While no special authority had been given by Congress to receive these articles, it was not considered proper to refuse them, and they were accordingly taken charge of by the several departments of the Government to which they were most nearly related. An exhibit of the iron, chain-cables, cordage, &c., of the naval department of Russia was received by the representatives of the Navy Department. To the Bureau of Education was delivered everything of an educational character. The Department of Agriculture received the articles belonging to the vegetable kingdom, such as sections of wood, fibers, grains, seeds, &c., while articles belonging to the mineral and animal kingdoms, and as illustrative of the manners and customs of the people, were taken by the Smithsonian Institution, and objects relating to the fisheries by the United States Fish Commission.

Accompanying communications from some of these departments give in fuller detail the character of these donations. Suffice it to say, that so far as the Bureau of Education, the Department of Agriculture, the Smithsonian Institution, and the Commission of Food-Fishes are concerned, the collections promise to exceed in magnitude their own Centennial exhibitions

PROPOSED TRANSFER OF THIS COLLECTION TO WASHINGTON.

General feeling on the subject.—The interest in the exhibition of the Government very naturally suggested to many the importance of transferring it to Washington and maintaining it in its original form, and numerous suggestions and earnest appeals to that effect have already appeared in the public press. This feeling met with special expression in a resolution of the National Academy of Sciences, at its session in Philadelphia in October; and in compliance with its instructions, Professor Henry, its president, transmitted to the President of the United States the following communication:

"SMITHSONIAN INSTITUTION,
"*Washington, D. C., November* 13, 1876.

"*To His Excellency the President of the United States:*

"SIR: I have the honor to inform you that at a meeting of the National Academy of Sciences, held in October last, the following preamble and resolutions were unanimously adopted:

"'Whereas the members of the National Academy of Sciences have been greatly impressed by the extent, rarity, and richness of the truly national collection contained in the Government building at the Centennial Exhibition, and considering the great importance and lasting interest with which the people of the United States must regard this collection: Therefore,

"'*Resolved*, That in the opinion of the Academy the Government collections as a whole should be transferred to Washington, and there preserved in an appropriate building for perpetual exhibition.

"'*Resolved*, That the Academy entertains the hope that the President

of the United States will favor the foregoing proposition; that he will delay the dispersion of the exhibit from the several Executive Departments until Congress has assembled, and that he will recommend to that body to provide for the transfer of the Government collection to the city of Washington, and for its subsequent permanent support.'

"In transmitting these resolutions to your Excellency, I beg leave, in favor of the proposition, to suggest, first, that the exhibit would form a fitting memorial of the centennial condition of the country; second, that it would illustrate in a striking manner the appliances used by the Government in carrying on its various and complex operations; third, that it would be a repository in which the natural resources of each State would be exhibited; fourth, that it would give information, in one view, of importance to the statesman, legislator, scientist, educator, and the capitalist of our own and of foreign countries; fifth, it would be of interest to the intelligent public at large, and would meet the approbation of all who regard the prosperity of the country, and take pride in the condition of the national capital.

"In conclusion, it may not perhaps be improper to remark that I do not advocate this proposition for the purpose of extending the power and influence of the Smithsonian Institution. On the contrary, I think the exhibit should be made a truly national one, and be immediately under the control of the Government.

"I have the honor to be, very respectfully, your obedient servant,

"JOSEPH HENRY,

"*President National Academy of Sciences.*"

Economical value of the collection.—Embracing as these donations do the essential portion of the displays of foreign nations, such as their natural products, general industries and educational and scientific methods, &c., it is clearly evident that the element of the Centennial Exhibition of most importance to the American people, has thus been left to it, in the closing of the Centennial, and if properly administered must conduce in a very great degree to the material and mental advance of the nation. By re-arranging it in a systematic manner, in connection with the articles already shown, a most instructive and important museum can be made available to the people of the United States. We are assured that no such collection as this is to be found in any part of the world; and it is very doubtful whether it can ever again be reproduced, as many of the nations represented at the Centennial have intimated their intention of not taking part in the Paris or any future exposition.

Distribution of duplicates.—As might be expected, a large amount of duplicate material accompanies these donations to the United States from American and foreign sources, which, when a final arrangement is accomplished, can, if Congress so direct, be distributed to various educational and industrial establishments throughout the United States.

Commercial value.—The expenditures of the United States, for an ex-

hibition lasting but six months have amounted to nearly $600,000. The donations from our own States and individuals, tending to fill up some of the gaps and complete the American display, which an insufficient appropriation interfered with, and those from foreign nations which have been given to the United States, can hardly be considered as overvalued at $400,000, and we therefore have an aggregate of property, in value, of at least a million of dollars to provide for.

Future increase of collections.—Promises have been made by most o the foreign commissions to complete any portion, illustrating the natura. products and industries of their respective countries whenever the arrangement of the collection shows the deficiencies.

Action of the President in regard to transfer.—In view of the magnitude of the collections thus acquired by the United States, and the inadequacy of any present provision for their transfer to Washington, and their arrangement here, as also in view of the urgency of the appeal of the National Academy of Sciences, the President, under date of November 17, 1876, issued an order forbidding the removal of the articles in the Government building until some arrangement could be made in regard to them. This order was subsequently modified by allowing such objects as were required for the use of the Government in Washington or elsewhere, to be transferred, as also such as were liable to decay or injury by remaining in a building exposed to cold and dampness. The greater part of these articles are now stored in the Government building at Philadelphia, waiting some action on the part of Congress.

Demolition of Government Centennial building soon required.—As the contract made by the park commission with the Centennial Commission requires the removal of all the buildings within 60 days of the close of the exhibit, it is necessary to take speedy action on this subject; and if Congress does not see fit to erect a building at the present time for the proper display of the collections, measures must at any rate be authorized for their removal to Washington, and their storage in some safe place, as the appropriations made to the Government board did not contemplate these foreign and domestic donations in their enormous aggregate, and are entirely inadequate to handling them. The articles of this character, in charge of the Smithsonian Institution alone, will, it is stated, fill fifty freight-cars to their utmost capacity, in addition to the collections prepared by the Institution directly for the exhibition, and moved from Washington to Philadelphia in the spring of 1876.

As the Government building embraced an area of about 100,000 square feet, it is evident that one of less magnitude would not suffice for the reproduction of an exhibit of the original and acquired material.

REPORT

OF

PROFESSOR JOSEPH HENRY,

SECRETARY OF THE SMITHSONIAN INSTITUTION

FOR THE YEAR

1877.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1878.

REPORT OF JOSEPH HENRY, SECRETARY, FOR THE YEAR 1877.

To the Board of Regents of the Smithsonian Institution:

GENTLEMEN: I have the honor herewith to present to you a report of the operations and condition of the Institution, intrusted to your care by the Government of the United States, for the year 1877.

INTRODUCTION.

Nothing of special importance has occurred during the past year to vary the conditions and operations of the establishment, while from the following report I think it will be evident that it has continued faithfully to discharge the duties assigned it by the will of the founder, as well as to carry out the directions prescribed by Congress in the act of its organization.

In the last report a full account was given of the operations of the Institution in connection with the Centennial Exhibition, and in relation to this the Board of Regents addressed a memorial to Congress, asking for an appropriation of $250,000 for the erection of a new building, principally to accommodate the articles presented by foreign governments to the National Museum under the care of the Institution. A bill in favor of this petition was presented to the Senate by the Hon. Mr. Morrill, of Vermont, which passed without opposition. It failed, however, to pass the House of Representatives, although a majority of the members approved of it, because it could not be brought before the House without a two-thirds vote in favor of its consideration. The same bill will again be presented, and the hope is confidently entertained that it will receive the approbation of Congress. In anticipation of this result a plan of the building has been prepared under the direction of General Meigs.

In the two preceding reports I have called the attention of the Board of Regents to the propriety of a final separation of the Institution from the National Museum, and nothing has occurred during the past year to change my opinion on this point. Although I do not urge this for immediate action, yet I think it should be kept in view, and the proposition at a favorable time presented to Congress. My reason for advocating this proposition is that Smithson gave his own name to the establishment which he founded, thereby indicating that he intended it as a monument to his memory, and in strict regard to this feature of his will his bequest should be administered separately from all other funds and the results achieved by it, accredited to his name alone. The Institution,

therefore, should not be merged in any establishment of the government, but should stand isolated, free to the unobstructed observation of the whole world, keeping in per tual remembrance the will of its founder.

The functions of the Institution and the Museum are entirely different; those of the Institution being—first, to enlarge the bounds of human thought by assisting men of science to make original investigations in all branches of knowledge, to publish these at the expense of the Smithson fund, and to present copies of them to all the principal libraries of the world; second, to institute investigations in various branches of science and explorations for the collection of specimens in natural history and ethnology to be distributed to museums and other establishments; third, to diffuse knowledge by carrying on an extended international series of exchanges by which the accounts of all the original researches in science, the educational progress, and the general advance of civilization in the New World are exchanged for similar works of the Old World. To carry out this plan the Institution requires no costly building, but merely accommodations for receiving and distributing its collections.

The Museum, on the other hand, is intended to embrace a collection of specimens of nature and art which shall exhibit the natural resources and industries of the country, or to present at one view the materials essential to the condition of high civilization which exists in the different States of the American Union; to show the various processes of manufacture which have been adopted by us, as well as those used in foreign countries; in short, to form a great educational establishment by means of which the inhabitants of our own country, as well as those of foreign lands who visit our shores, may be informed as to the means which exist in the United States for the enjoyment of human life in the present, and the improvement of these means in the future.

The support of such an establishment must, of necessity, be derived from Congress, and no part of the income of the Smithson fund should be devoted to this purpose, since it is evident from the will of Smithson that he intended his benefaction for the good of mankind, and therefore all expenditures on local objects, or even on those limited to the United States, are not in conformity with the intentions of the donor. A very objectionable result of the present connection of the two establishments is the necessity for the Institution to appeal to Congress annually for an appropriation for the support of the Museum, whereby the Institution is presented to the world as a suppliant for aid, although, for carrying out the legitimate objects of the bequest, no annual appropriation from the public Treasury is necessary.

The whole of the Smithsonian building is now required for the National Museum, and, in case of the separation, a new building should be provided for the accommodation of the Institution; and when the financial condition of the country shall be better, I trust the sense of justice of the people of the United States will induce Congress to restore to the funds

of Smithson at least a part of the $500,000 which have been expended on the building from the income of the Smithson bequest. I know that the present is a very unfavorable time for presenting this proposition to Congress, but I do not despair of its being favorably received hereafter.

Among the minor incidents of the year was the reception of a letter from M. de la Batut, of Belz, France, the half-brother of the nephew of Smithson, to whom he bequeathed his property, and in case of whose death it was to be devoted to founding the Smithsonian Institution. With this letter was a miniature likeness of James Smithson and another of Colonel Dickinson, the half-brother of Smithson, which were offered for sale to the Institution, and were finally purchased for the sum of $100. Accompanying these portraits was what appeared to be the original draft of Smithson's will, slightly differing in one particular from that previously published in the Smithsonian report for 1853, and also a series of notes addressed to Smithson by some of the most distinguished scientists of his day. Among these are those from Oersted, Arago, Biot, Lester, Tennant, Klaproth, and others, which would be highly prized by collectors of autographs, and which serve to show the intimate association of Smithson with the most distinguished cultivators of science at the beginning of the present century.

There are now in the Institution three likenesses of Smithson, one a small full-length picture, which was purchased from his servant, John Fittall, and represents him in the costume of a student at Oxford; another, a small medallion, which was among his effects; and the third is the one above mentioned. As a part of the legacy of Smithson there were received a small library and several large trunks filled with clothing, some articles of apparatus, a silver-plated dinner set, two small cabinets of minerals, and a large collection of papers, including correspondence. All of these, except the library, were destroyed in the fire of 1865. The effects were, however, of little value, except as mementos. The manuscripts consisted principally of private letters and a series of sentences arranged according to the letters of the alphabet, as if they were intended for a philosophical dictionary. The library, which is still preserved, consists of 123 volumes and 88 pamphlets, and is preserved in a separate case in the Regents' room of the Institution.

In the report of the Institution for 1853 I gave a list of the scientific papers of Smithson which were published in the Transactions of the Royal Society of London and in scientific periodicals. Although at the present day there is nothing in these papers of very special interest, since the facts which he communicated have since been merged in the general progress of science, yet it might be well to republish them in a separate volume as an illustration of the character of the founder of the Institution and to mark his connection with the science of his day.

In the report for the year 1876 an account was accidentally omitted of the decease of Fielding B. Meek, an esteemed collaborator of this

Institution, who occupied for upward of twenty years a room in the Smithsonian building and assisted without salary in the operations of the establishment. He was devoted to paleontology, and was one of the principal authorities in the country in the line of fossil shells. At the time of his death he had just completed a large volume on the paleontology of the Upper Missouri, published in connection with Dr. Hayden's surveys. He was obliged on account of his health to spend his winters in Florida, but, delaying his departure too long and unduly exerting himself the day before he intended to leave, he was seized with a hemorrhage, and, after an illness of a few days, died on the 21st December, 1876. He was born in the city of Madison, Ind., December 10, 1817, and had therefore just completed his fifty-ninth year at the time of his death. His grandparents were Irish Presbyterians, who emigrated to this country from the county of Armagh about the year 1768. His father died when he was but three years old, leaving the family in moderate circumstances. He was educated in the public schools of Madison. His attention was early attracted to the fossil shells so abundant in the rocks in the vicinity of his home. Arriving at the age of manhood, he invested the small sum received from his father's estate in mercantile business, but having no taste for that occupation, and neglecting it to pursue his studies, a failure was the consequence. He then devoted himself as a means of livelihood to portrait-painting, continuing his scientific studies, especially in the line of geology. In the year 1848 he was associated with David Dale Owen in the geological survey of Iowa and Minnesota, and in 1852 became an assistant to Professor Hall in the preparation of the paleontology of the State of New York. Under the direction of Professor Hall he explored the Bad Lands of Nebraska, and collected a valuable series of fossils. In 1858 he came to Washington, where he resided continuously to the time of his death, leaving the city for a few months only from time to time while engaged in studying the paleontology of Illinois, Ohio, and California, and later in Florida during the winter on account of his health. During his residence in the Institution he gradually lost his hearing, and could only be communicated with by means of writing. He gradually withdrew from social intercourse, and devoted his life exclusively to the prosecution of science. He was in correspondence with the principal investigators of the world in the line of paleontology, and although scarcely known in this city his name was familiar to the cultivators of geology everywhere. He was a man of singular truthfulness and critical accuracy, and was highly esteemed by the few who had the pleasure of his acquaintance. His death has been widely announced in all the scientific journals of the day, but no relative has appeared to claim his property. As secretary of the Institution with which he had been so long connected, I considered it my duty to assume the office of administrator, and as a year has now elapsed since the time of his decease I am about to make a report of the condition of his estate to the orphans' court of the District of Columbia. The final disposition of his

property, which is partly in lands in Kansas, cannot be determined at present, and if not claimed by heirs may possibly require the action of Congress.

MEETING OF THE ESTABLISHMENT.

The law of Congress organizing the Smithsonian Institution directs that the President and his Cabinet, the Chief Justice, the Commissioner of Patents, and such other persons as they may elect honorary members, may hold stated and special meetings for inspecting the affairs of the Institution, and, in accordance with this provision, a meeting of that body was held on the 5th of May, 1877. There were present the President of the United States, R. B. Hayes; the Secretary of State, W. M. Evarts; the Secretary of the Treasury, John Sherman; the Secretary of War, George W. McCrary; the Secretary of the Interior, Carl Schurz; the Attorney-General, Charles Devens, and the Postmaster-General, D. M. Key.

The Secretary of the Institution, who is also the secretary of this body, gave a full account of the history, operations, and state of the finances of the Institution; and, after listening to it with interested attention, the President, on behalf of the meeting, expressed the opinion that the condition and management of the Institution were entirely satisfactory, and that they had no improvement to suggest. After inspecting the building, the museum, and the system of exchanges, and examining the publications, the meeting adjourned to meet on the 1st Tuesday in May, 1878.

FINANCES.

The condition of the funds is nearly the same as in 1876. The only difference is a diminution in the marketable value of the Virginia bonds which has fallen from $42,000 to $34,562. This decline was occasioned by propositions made in the legislature of the State which were thought to savor of repudiation, but those propositions have not met with favorable consideration, and it is now confidently expected that the bonds will again advance in value.

The following is a statement of the condition of the fund at the beginning of the year 1878:

The amount originally received as the bequest of James Smithson, of England, deposited in the Treasury of the United States in accordance with the act of Congress of August 10, 1846	$515,169 00	
The residuary legacy of Smithson, received in 1865, deposited in the Treasury of the United States in accordance with the act of Congress of February 8, 1867	26,210 63	
Total bequest of Smithson		541,379 63
Amount deposited in the Treasury of the United States, as authorized by act of Congress of February 8, 1867, derived from savings of income and increase in value of investments		108,620 37

Amount received as the bequest of James Hamilton, of Carlisle, Pa., February 24, 1874	$1,000 00
Total permanent Smithson fund in the Treasury of the United States, bearing interest at 6 per cent., payable semi-annually in gold	651,000 00
In addition to the above, there remains of the extra fund from savings, &c., in Virginia bonds and certificates, viz: Consolidated bonds, $58,700; deferred certificates, $29,375.07; fractional certificate, $50.13; total, $88,125.20, valued January, 1878	34,562 00
Cash balance in United States Treasury at the beginning of the year 1878 for current expenses	25,083 90
Total Smithson funds January 6, 1878*	$710,645 90

The receipts during the year 1877 were $49,007.62, and the expenditures $44,952.90, leaving a balance of $4,054.72 to be added to the balance on hand at the beginning of 1877.

The interest on the Virginia bonds received during the year was $2,885.76, realized from the sale of coupons amounting to $3,522.

The interest on the Hamilton bequest of $1,000 has been received to the 31st December, 1877. There is now a balance on hand of interest amounting to $96.17, which will be available during the present year in accordance with the terms of the bequest.

BUILDING.

Attention having been specially called to the condition of the public buildings in this city, on account of the destruction by fire of part of the Patent Office, it was deemed advisable to give additional security to the valuable collections deposited in the Smithsonian edifice. The main building, which contains the National Museum, is entirely fire-proof, but the connecting ranges and the two wings are not so. It was therefore highly desirable that the main building should be entirely isolated from the ranges and wings. For this purpose the large windows facing the wings were bricked up, and all the doorways leading from the museum into the ranges either bricked up or fitted with iron instead of wooden doors. The carpenter's and machinist's shops were removed to the main basement and inclosed in brick walls. The storage rooms were made fire-proof by replacing wooden partitions and floors, by those of brick. In the high central tower brick partitions have been constructed on the stairways, to prevent the passage of fire from one story to another.

PUBLICATIONS.

The publications of the Institution are of three classes, viz, the CONTRIBUTIONS TO KNOWLEDGE, the MISCELLANEOUS COLLECTIONS, and

* The date at which the settlement of the accounts for 1877 was made.

the ANNUAL REPORTS. The first consists of memoirs containing positive additions to science resting on original research, and which are generally the result of investigations to which the Institution has, in some way, rendered assistance. The Miscellaneous Collections are composed of works intended to facilitate the study of various branches of natural history, meteorology, &c., and are principally designed to induce individuals to engage in these studies as specialties. The Annual Reports, besides an account of the operations, expenditures, and condition of the Institution, contain translations from works not generally accessible to American students, reports of lectures, extracts from correspondence, &c.

The following are the rules which have been adopted for the distribution of the several publications of the institution:

1st. They are presented to learned societies of the first class which in return give complete series of their publications to the Institution.

2d. To libraries of the first class which give in exchange their catalogues and other publications, or an equivalent from their duplicate volumes.

3d. To colleges of the first class which furnish catalogues of their libraries and of their students, and all other publications relative to their organization and history.

4th. To States and Territories, provided they give in return copies of all documents published under their authority.

5th. To public libraries in this country, containing 15,000 volumes, especially if no other copies are given in the same place; and to smaller libraries where a large district would be otherwise unsupplied.

6th. To institutions devoted exclusively to the promotion of particular branches of knowledge are given such Smithsonian publications as relate to their respective objects.

7th. The Annual Reports are presented to the meteorological observers, to contributors of valuable material to the library or collections, and to persons engaged in special scientific research.

The most important memoir accepted during the year for publication in the Smithsonian Contributions is entitled "Archælogical and Ethnological Researches in Central and South America, with a Detailed Account of the Sculptures at Santa Lucia Cosumalhuapa," by Dr. Habel, of New York. This gentleman, having an ardent desire to make an exploration of the physical geography and anthropology of Central America, relinquished his medical practice in 1862, and commenced a tour of exploration in that region. In the course of seven years which he devoted to these explorations he made collections in natural history and observations in meteorology, topography, geology, and archæology. On arriving at Guatemala he made that city his headquarters, from which four excursions were undertaken.

The first was directed to an unexplored region lying north of Guatemala, reported to be inhabited by the Lacandones, a tribe said never to have been subdued by Europeans. On the route, Dr. Habel heard of

the remains of two cities near Rabinal, one of which, twelve miles from the town, he visited. These ruins occupy the summits of three hills, and some of the edifices are tolerably well preserved. The most conspicuous one was 100 feet long by 30 feet broad. Its floor was elevated four steps above the ground, and the walls left standing were about 6 feet high. It seems to have had four entrances, one on each side. The interior space was 18 feet broad by nearly 90 feet long. All the buildings were constructed of thin slabs of mica-gneiss laid in courses like bricks and united by a granular kind of mortar. The walls had been plastered outside and inside. On the side of the hill were found arrow-heads and spear-points of obsidian and other minerals.

Arriving at Salinas there were found vestiges of the ancient population in a squared-stone pyramid, heaps of broken pottery, &c. A vocabulary of the Egkschi language was collected. After waiting a month for a boat to convey him to his intended destination, he was obliged to relinquish the attempt and return to Guatemala.

The second exploration was to the borders of Mexico, and ancient ruins were visited at Guequetenango, Palyah, and Saycap.

On the third excursion the sculptures of Copan, in Honduras, described by Stephens and others, were visited. Those of Guirigua are of great archæological interest. These are of various sizes and shapes, the tallest being of columnar form about 25 feet high, while others do not exceed 12 feet. All of them have four sculptured sides, the front and rear being the widest. The narrow sides of all the columnar monoliths are covered with hieroglyphics resembling those found in Copan.

The fourth excursion was undertaken to visit a newly discovered series of sculptures at Santa Lucia Cosumalhuapa, the description of which forms the principal part of this memoir. On the way to this place very interesting sculptures were found on the plain near the Hacienda los Tarros, which exhibit fine workmanship and represent human figures in high relief. They are 5 feet 9 inches high, 3 feet 7 inches broad, and 1 foot 8 inches deep, standing on a base 10 inches high.

Before describing the objects found at Santa Lucia the author gives an account of some other expeditions. The first of these was to the Republic of Honduras, but no archæological objects were observed. Vocabularies and valuable information, however, were collected from various native tribes.

A visit was also made to Nicaragua, where a sculptured figure was seen on the corner-stone of a house, and other remains were found in and near the town. A grotesque figure was observed sculptured on a rock, forming the bank of a brook, which is the only instance of sculpture found by the doctor on rocks *in situ*.

A visit to Costa Rica did not produce any results of interest. The largest field for archæological discoveries is considered by Dr. Habel to be found in San Salvador, and an account is given of several sculptures and mounds he examined there.

Leaving Central America, Dr. Habel visited parts of Colombia, Ecuador, and Peru, which he found rich in architectural structures erected by the ancient inhabitants. Descriptions and measurements of some of these are given in the memoir.

The author, however, as we have said, devotes the principal part of this work to a description of the monoliths at Santa Lucia Cosumalhuapa, a small town in the Department of Esquintla, near the base of the volcano del Fuego, at the commencement of the slope which extends from the mountain range to the Pacific coast. The village is of comparatively modern origin and is in the midst of an extensive orange-grove, which yields so abundantly that the fruit is almost given away, and the great number of trees is accounted for by the custom prevailing of planting a tree by each head of a family at the birth of each child. A short time before the arrival of Dr. Habel in the country the monoliths had been discovered by a man who, in digging a field to prepare the ground for planting cotton, came upon a large pile of stones which, on examination, were found to be sculptured. To make drawings of these was no easy task, for the dirt and moss attached to them had to be removed—a very tedious work. To secure true copies of the originals, strings were stretched over each slab, six inches apart, thus dividing them into squares. The sketch-book was ruled in squares of half an inch, and in each of these a copy of a square of the slab was drawn, making the drawings all one-twelfth the linear size of the original. The slabs form an extended heap, rendering it probable that there are others hidden from view which further researches would reveal. All the sculptures are in low relief, nearly all being in *cavo-relievo;* that is, surrounded by a raised border. In seven instances the sculpture represents, according to the author, a person adoring a deity of a different mythological conception in each case. One of these seems to represent the sun, another the moon, while the character of the others it is impossible to define. These deities are represented by a human figure, of which the head, arms, and breast are correctly portrayed. Four of the other sculptures represent allegorical subjects. The stones on which the low reliefs are sculptured came from the volcano of Ocatenango, and most of them are 12 feet in length, 3 feet in width, and 2 feet in thickness. Nine feet of the upper part of these stones are occupied by sculptures, while the lower 3 feet appear to have served as a base. Very minute descriptions are given of each of these sculptures, and an attempt is made by the author to explain the significance of all the emblems, ornaments, figures, &c., forming the design on each slab.

The author also indulges in speculations as to the origin and symbolism of the sculptures, which are ingenious, novel, and many of them apparently very reasonable, while others will undoubtedly be accepted with much hesitation, and will perhaps be rejected as untenable by students of archæology.

The author was invited to visit Washington, where a room was pro-

vided for him at the Institution and the drawings of these sculptures were reproduced by an artist under his personal supervision and constant instruction. The expense of the preparation of the manuscript and illustrations as well as of the publication has been borne by the Smithsonian Institution. The publication of the work was recommended by several of the leading archæologists of the country, and in a report in regard to it Prof. W. D. Whitney remarks, "It seems to me a story refreshing by its brevity and simplicity, very unlike the pompous and boastful way in which such things are often heralded. One may not agree with all the inferences drawn at the end, but that is a matter of very small importance; no two persons would arrive at precisely the same conclusions. So far as I can judge, the Institution has every reason to take pleasure and pride in the issue of such a contribution to American archæology." The sculptures represented are of such a remarkable character that it has been thought advisable to institute some further inquiries in regard to their present condition; and, fortunately, an opportunity has occurred which enables the Institution to do this without making any draft upon its income. The Government of Guatemala having requested the Government of the United States to nominate a competent geologist to make explorations of mines in the former country, the Secretary of State referred the matter to the Secretary of the Smithsonian Institution, who nominated Mr. Arnold Hague, who had been engaged on the survey of the fortieth parallel under Clarence King, a gentleman well qualified to discharge the duties intrusted to him. He has been requested to visit the region in question and to report on the state of the sculptures described in the memoir of Dr. Habel as well as on any archæological remains of interest which he may meet with in the course of his explorations in the country.

In previous reports a paper has been mentioned which is the result of the investigations of the late Prof. Henry J. Clark relative to *Lucernaria*, a class of animals formerly regarded as *polyps*, but more recently associated with the *acalephæ* or sea-nettles and jelly-fishes. It was presented to the Institution several years ago, but the publication has been delayed by a series of unexpected hindrances. Much delay was experienced at first in obtaining proper engravings of the very minute and complicated drawings to illustrate the work, and before these were completed the author was called from this life, in the flower of his age and in the midst of a series of successful investigations. After his death it was found difficult to obtain the services of a person sufficiently acquainted with the subject to read the proof-sheets, but during the year the printing has been commenced under the supervision of Prof. A. E. Verrill, of Yale College. Unfortunately, another delay has been occasioned by the ill-health of this gentleman. We hope, however, that the work will be completed in the course of a month or two and will be ready for distribution at an early day.

During the year 1877, a paper has been published in the "Contributions to Knowledge" on the "Internal structure of the earth considered as affecting the phenomena of precession and nutation," by General J. G. Barnard, United States Army. This is a supplementary article to one by the same author published in the nineteenth volume of Contributions, and was read before the National Academy of Sciences at its session in April, 1877.

For several years past Mr. P. P. Carpenter, author of the "Lectures on Mollusca," and the "Mollusks of Western North America," published by the Institution, has been engaged in the preparation of a monograph of the *Chitonidæ*, or coat-of-mail shells, a remarkable group of shell-fish. An appropriation was made in 1877 to enable him to have drawings prepared of rare type-specimens in Europe. We regret to state, however, that before his work was completed Mr. Carpenter died at Montreal, on the 24th May, 1877. He was the son of the well-known Dr. Lant Carpenter, and a member of a family distinguished by great gifts. He was born in Bristol, England, in 1819, and after graduating at the University of Edinburgh became a minister of the gospel. He early manifested a taste for natural history, particularly of the mollusks, which he made his special study during his life. He presented to the British Museum his own collection of shells, consisting of 8,873 specimens, all determined, and many of them described by himself. In 1859 he visited America, where he was engaged in determining the collections of shells in the Smithsonian Institution and other museums. His manuscripts were left in an imperfect condition, and partly written in an obsolete phonographic short-hand. An attempt at having this short-hand deciphered is being made, by the help of his brother, the Rev. Russell L. Carpenter, of Bridport, England. A large number of beautiful drawings of the shells and soft parts of the various genera had been prepared at the cost of the Institution, and the manuscript, or such portions of it as may be made available, have been placed in the hands of Mr. W. H. Dall for revision, with a view to their ultimate publication. It is believed that this monograph will form a valuable contribution to the knowledge of the invertebrate animals of the world.

In the report for 1875 it was stated that 184 pages had been stereotyped of the Botanical Index prepared by Prof. Sereno Watson. This work is intended to facilitate the labors of botanists, especially in the study of the plants of the western portions of the United States, by furnishing references to all the published descriptions of species of the flora of North America with lists of synonyms. The search for what has been written frequently consumes more time and labor than all the rest of a botanical investigation, and the present work has been undertaken at the urgent solicitation of some of the principal botanists of the country, who have also contributed to the expense of its preparation. Other duties of Professor Watson have been so engrossing that

he has not yet been able to complete this work. It is now proposed, as recommended by Professor Gray, to publish the pages already stereotyped, as part 1, since this will cover the ground of volume 1 of Torrey and Gray's Flora of North America and be complete in itself as far as it goes. A short preface will be given, and at the end an index to the genera. It will include nearly 500 pages, and can be printed and distributed early in the year 1878.

The "Toner Lectures" have been instituted at Washington by Dr. Joseph M. Toner, a practicing physician of this city, who has placed in charge of a board of trustees, consisting of the Secretary of the Smithsonian Institution, the Surgeon-General of the United States Army, the Surgeon-General of the United States Navy, and the president of the Medical Society of the District of Columbia, a fund, the interest of which is to be applied annually for a memoir or essay relative to some branch of medical science, and containing some new truth fully established by experiment or observation. As these lectures are intended to increase and diffuse knowledge, the Institution has accepted them for publication in its series of "Miscellaneous Collections." The following is a list of the lectures already published:

1. On the structure of cancerous tumors and the mode in which adjacent parts are invaded. By Dr. J. J. Woodward. November, 1873. 44 pp. 8vo.

2. The dual character of the brain. By Dr. C. E. Brown-Séquard. January, 1877. 25 pp. 8vo.

3. Strain and overaction of the heart. By Dr. J. M. Da Costa. August, 1874. 32 pp. 8vo.

4. A study of the nature and mechanism of fever. By Dr. Horatio C. Wood. February, 1875. 48 pp. 8vo.

5. On the surgical complications and sequels of the continued fevers. By Dr. W. W. Keen. April, 1877. 72 pp. 8vo.

6. Subcutaneous surgery; its principles and recent extension in practice. By Dr. William Adams. May, 1877. 20 pp. 8vo.

Of the above series, the second, fifth, and sixth have been published during the past year. The second, by Dr. Brown-Séquard, was not printed in its regular order on account of the failure of the author to furnish the manuscript of the lecture, and it was finally published from short-hand notes taken at the time by a reporter.

Appended to the lecture of Dr. Keen on fever is a bibliography, including works referring more or less briefly to several diseases, viz: 1, diseases of the joints; 2, diseases of the bones; 3, diseases of the larynx; 4, gangrene; 5, hæmatomata; 6, diseases of the eye; 7, phlegmasia; 8, miscellaneous.

To defray in part the cost of printing these lectures, they are sold at 25 cents each.

The records of scientific discoveries have become so extended and so distributed among works forming whole libraries, that to become

acquainted with what is known in any branch, would be a labor of such magnitude as to form a serious obstacle to the advance of knowledge were not means devised for facilitating this labor. The means adopted for this end are classified indexes of special subjects in which may be found everything of importance which has been published in regard to the subject.

The Royal Society's Catalogue of Scientific Papers is a boon to science, and is of great importance to every original investigator, but it is arranged solely under authors' names, and contains only references to papers appearing in periodicals published since 1800, excluding all books published separately. To supplement this the Institution has published during the year an index of books and memoirs relating to nebulæ and star clusters, by Prof. E. S. Holden, of the Washington Observatory. This index includes all papers, memoirs, and books on nebulæ and clusters alphabetically arranged according to authors, giving, for each reference, volume and page. Where the title of a book or paper explains the subject of it, such title is, in general, alone given. Where a paper is quite important its title is given, and if necessary, a note more or less brief, expressive of its contents. The works of the elder Herschel on these subjects are analyzed at considerable length, in order partly to supply the great want of an edition of his collected works. In the case of papers of minor interest, a reference to the periodical, volume, and page is alone given (no title), and a note of its purport. In addition to this, there is given a very condensed reference to the papers in each periodical consulted. In this way a person consulting the catalogue will find all the works of any author upon the general subject, with brief notes of the contents of each paper; or again, any person desiring to refer to the various papers on this subject contained in any serial publication, as the Philosophical Transactions, for example, will find references which will save him much time. The index is practically complete to the present date; it contains a complete list of all published (and many unpublished) drawings of nebulæ and clusters, and also an index to Sir William Herschel's classes of nebulæ.

In the last two reports an account was given of a new series of publications to form part of the "Miscellaneous Collections," entitled "Bulletins of the National Museum," and intended to illustrate the collections of natural history and ethnology belonging to the United States, of which the Smithsonian Institution is the custodian. They are prepared at the request of the Institution by different individuals, and are printed, by the authority of the Secretary of the Interior, at the Government Printing Office.

Since the date of the last report, numbers 7, 8, and 9 of the Bulletins have been published.

No. 7 is a contribution to the Natural History of the Hawaiian and Fanning Islands and Lower California, by Dr. Thomas H. Streets, passed assistant surgeon, United States Navy. The collection that furnished

the materials for this Bulletin were made by Dr. Streets while connected with the North Pacific Surveying Expedition in 1873–'75. The Fanning group consists of four small coral islands, Christmas, Fanning Washington, or New York, and Palmyra. They are situated immediately north of the equator, extending from latitude 1° 57′ north to 5° 49′ north, and from longitude 157° 27′ west to 162° 11′ west. Three of these islands have been *terra incognita* to the naturalist, and furnish much new matter. This was particularly the case with Washington Island, which is an obliterated atoll, having been lifted up by some disturbing force, so as to close up the lagoon-outlet, and what was the old salt-water lagoon is now a fresh-water lake. It is probable that the salt-water of the lagoon has drained off through the light, porous soil, and its place been supplied by rain-water. It is unfortunate that the exigencies of the naval service did not permit of a longer stay at this island, and especially that sufficient time was not given to investigate the life in the fresh-water lake. During the half day which he was allowed to remain on the island, Dr. Streets succeeded in fixing the habitat of a lory (*Coriphilus kuhli*), which has long been a puzzle to ornithologists, and he also discovered a diminutive species of the gadwell duck inhabiting the lake. The specimens of the lory brought home by Dr. Streets are, it is believed, the only ones in this country; and they are exceedingly rare in the museums of Europe. The island is densely covered with vegetation, the cocoanut-palm tree predominating. The collection represents the complete avi-fauna of the group during the winter months, with two or three exceptions. A point of interest in connection with the fish collection is that it extends the area of distribution of many species that were previously confined to the East Indian region. The conditions surrounding life on the southernmost island of the group, Christmas, were generally found to be very different from that on the others; and in cases where it was the same, the habits of the species were observed to be greatly modified. The notes accompanying the names of the sea-birds are thought to be very interesting in this connection. Purely land-life, as is natural to be supposed, is very scantily represented on the islands. On Palmyra there was found a minute shell, a *Tornatellina*, and a land-leech, that fastened itself upon the eyelids of the young birds. Rats and house-flies are abundant, but neither are indigenous. In addition to the land-birds already mentioned, there was also observed on Washington a bird resembling a fly-catcher. Giant land-crabs were numerous on the same island.

After the Portsmouth, on which Dr. Streets was stationed, had completed the survey of the Fanning group, he was transferred to the Narragansett, which was making a survey of the west coast of Mexico. This portion of the collection does not pretend to be exhaustive even of any one locality, the nature of the work, a running survey, precluding the idea of a protracted stay in one place. The elucidation of some doubtful points in the history of two species of birds and an account

of the guano deposits in the Gulf of California are the only noteworthy items in connection with the ornithology of this region. Angel Island in the Gulf, was found to be the dwelling-place of two extremely rare Arizonian reptiles. In regard to fish, two more species are added to the number of those that are common to both the Atlantic and Pacific shores of the American continent.

The eighth number of the Bulletin is an index to the names which have been applied, previous to the year 1877, to the subdivisions of the class Brachiopoda excluding the Rudistes, by William H. Dall, of the United States Coast Survey. The Brachiopods are among the most characteristic forms by which geological strata are co-ordinated. Many genera have been described in little-known works by European authors, and many others in obscure American publications. Most of the names applied to these genera are duplications of one another. American and European authors have been retarded in their classification of the Brachiopods by this undigested synonymy. Mr. W. H. Dall has collected the history of all the names which have been applied to members of this group both properly and improperly, and added notes on their synonymy, relations and a geological table of the strata in which each group is found. This index affords the means for properly naming the national collection of these fossils, and it has received the approbation of Mr. Thomas Davidson, F. R. S., of England, the highest authority living on the subject of Brachiopoda. It is shown by this list that of sixteen families of Brachiopods, six have living representatives, one more than appear to have been represented during the Cambrian epoch, while but two of the Cambrian families have survived. All those living in Cretaceous times have endured till now. All now living had Paleozoic representatives, while half the Paleozoic families do not appear to have survived the changes which introduced the Mezozoic time. This work is an octavo of 88 pages.

The ninth Bulletin is entitled "Contributions to North American Ichthyology based primarily on the collections of the United States National Museum. Part I. Review of Rafinesque's Memoirs on North American Fishes." By Prof. D. S. Jordan. The object of the author of this paper is to present a series of identifications of the species of fresh-water fishes described by Rafinesque in his "Ichthyologia Ohiensis" and elsewhere, the result of nearly three years of field-work in the region explored by Rafinesque. It forms an octavo pamphlet of 53 pages.

Annual report.—The annual report of the operations of the Institution for the year 1876, was presented to Congress on the 16th day of February, 1877, and on the 28th of February a resolution was adopted by Congress ordering an edition to be printed of 10,500 copies, of which 1,000 were to be for the use of the Senate, 3,000 for the House of Representatives, and 6,500 for the use of the Institution. This was a reduction in the number usually ordered for distribution by the Institution of 1,000 copies.

The appendix to the report for 1876 contains translations of Arago's Eulogy on Gay-Lussac; Fialho's Biographical Sketch of Dom Pedro I; Pilar on the Revolutions of the Crust of the Earth; and Blondel on Jade; besides original articles on Kinetic Theories of Gravitation, by William B. Taylor; the Asteroids between Mars and Jupiter, by Prof. Daniel Kirkwood; the Latimer Collection of Antiquities from Porto Rico, by Prof. Otis T. Mason; Antiquities in Guatemala, by the Hon. George Williamson; Collections of Historical Documents in Guatemala, by Dr. C. H. Berendt; Observations on the Prehistoric Mounds of Grant County, Wisconsin, by Moses Strong; Deposits of Flint Implements, by Dr. J. F. Snyder; Ancient Mica Mines in North Carolina, by C. D. Smith; a Double-walled Earthwork in Ashtabula County, Ohio, by Stephen D. Peet; an Ancient Implement of Wood, by E. W. Ellsworth; Centennial Mission to the Indians of Western Nevada and California; Indian Forts and Dwellings, by Dr. W. E. Doyle; and the Sioux or Dakota Indians, by Col. Albert G. Brackett.

ANTHROPOLOGY.

Anthropology, or what may be considered the natural history of man, is at present the most popular branch of science. It absorbs a large share of public attention and many original investigators are assiduously devoted to it. Its object is to reconstruct, as it were, the past history of man, to determine his specific peculiarities and general tendencies. It has already established the fact that a remarkable similarity exists in the archæological instruments found in all parts of the world with those in use among tribes still in a savage or barbarous condition. The conclusion is supported by evidence which can scarcely be doubted, that by thoroughly studying the manners and customs of savages and the instruments employed by them, we obtain a knowledge of the earliest history of nations which have attained the highest civilization.

It is remarkable in how many cases customs existing among highly civilized peoples are found to be survivals of ancient habits. Indeed it is asserted, and with at least apparent truth, that every unmeaning ceremony found in rural life in Europe and America, is a survival of an important custom connected with an essential condition of life in the aboriginal race. Hence, to clearly apprehend the manners and customs of modern society, it is necessary to study them in connection with the myths, the ceremonies, and the usages of ancient people.

American anthropology early occupied the attention of the Smithsonian Institution. To collect all the facts which could be gathered in regard to the archæology of North America, and also of its ethnology, or, in other words, an account of its present Indian inhabitants, was considered a prominent object in the plan of operations of the establishment. The first volume of its Contributions, whereby its plan of intended operations was illustrated, consists of an elaborate and expensive work on the "Ancient Monuments of the Mississippi Valley"; and from the time of

the publication of this volume until the present, contributions of value have been made annually by the Institution to this branch of knowledge.

During the past year small appropriations were made as usual for opening mounds and collecting their contents, and larger ones to Mr. F. A. Ober, for archæological explorations in the West Indies, and Stephen Bowers for similar operations in California. The former gentleman has succeeded in finding remnants of the ancient Carib tribes, and has obtained photographs of the people and specimens of their handiwork. His exploration bids fair to produce a valuable return for the money expended. It is not confined to ethnology, but embraces collections in all branches of natural history.

The exploration by Mr. Bowers was a continuation of one undertaken in connection with Major Powell, and was made in the vicinity of Santa Barbara and on the islands adjacent to Lower California. From this exploration forty boxes of very interesting relics of the ancient inhabitants of this country have been received. A full report of these will be prepared by Major Powell. The entire series of objects obtained become the property of the National Museum.

As will be seen from the exhibit of the executive committee, the whole amount of money devoted to explorations during the year is $879.50.

The collection of the archæology and ethnology of America in the National Museum is the most extensive in the world; and, in order to connect it permanently with the name of Smithson, it has been thought advisable to prepare and publish at the expense of the Smithson fund an exhaustive work on American anthropology, in which the various classes of specimens shall be figured and described.

For this purpose Mr. Charles Rau, formerly of New York, well known for his contributions to American archæology, has been employed to take charge of the work, with the assistance of skilled artists. He is furnished with rooms in the building, and now devotes one-half of the time to the arrangement of the archæological museum, and the other to the description of the specimens and the direction of the artists engaged in delineating them.

The Institution has also lately entered upon a project it has long had in contemplation, namely, the compilation of a map of the distribution and character of the archæological remains of North America. The preliminary arrangements for this work have been intrusted to Prof. Otis T. Mason, of Columbian University, who has prepared a circular which will soon be published by the Institution.

In the last report it was stated that the large collection of Indian vocabularies in possession of the Institution had been transferred to Prof. J. W. Powell, to be incorporated with his series in his general work on the ethnology of the Territories of the United States in course of preparation and publication by the Interior Department. What has been accomplished during the past year in relation to this work will be seen in Professor Powell's account of his explorations, given in the appendix to the report of the Secretary.

Reference was made in the last report to the "Instructions for research relative to the ethnology and philology of America," prepared in 1861 by Dr. George Gibbs, and the fact was stated that a new edition of this work had been undertaken in behalf of the Institution by Professor Powell. During the year 1877, a volume entitled "Introduction to the Study of Indian Languages" has been printed, and a few copies distributed among those interested in the study of Indian languages for such additions and emendations as may be suggested preparatory to final publication. In its preparation Professor Powell was assisted by Prof. W. D. Whitney, the distinguished philologist.

METEOROLOGY.

The Institution during the past year has continued its labors in the line of the reduction of meteorological observations. It has been especially engaged in the discussion of material for a new edition of the Rain-fall Tables for North America. It has also reduced and printed the observations made by Professor Caswell at Providence, from the termination of his series of meteorological observations published in 1860 down to the close of 1876, the whole making a continuous series for a period of forty-five years. Long series of this kind are of great importance in determining any change of climate which may have occurred during the period which they embrace.

We mention in regard to this series an interesting fact in connection with the supposed change in the rain-fall in different parts of the United States due to the clearing off of forests. If, for example, we take from this series three ten-year periods, one at the beginning, one at the middle, and one at the end, we observe a regular increase instead of diminution in the amount of rain-fall in Providence, as shown by the following figures:

From 1832 to 1841, average 38 inches.

From 1852 to 1861, average 44 inches.

From 1867 to 1876, average 49 inches.

This fact, however, may be in some way connected with the custom which, I am told, has become common in New England since the inhabitants have devoted themselves largely to manufactures, of allowing a considerable portion of the soil which was formerly under cultivation to grow up in wood.

The next series of observations which remains to complete the results of the whole meteorological system of the Smithsonian Institution will be that on the pressure of the atmosphere, which is intimately connected with the dominant winds in different parts of the country.

The miscellaneous work by the meteorological computers of the Institution during the year 1877, is as follows:

1. Tabulating the mean temperature and the maxima and minima of temperature for the Smithsonian stations for the years 1871–'72–'73.

2. Tabulating rain-fall, temperature, and maxima and minima for Canadian stations, 1875.

3. Tabulating rain-fall for Signal-Service stations, January, 1875, to July, 1876.

4. Making corrections and additions to rain-fall manuscript.

5. Making indices to the rain-fall and maxima and minima tables.

TELEGRAPHIC ANNOUNCEMENT OF ASTRONOMICAL DISCOVERIES.

The arrangement which was established between the Smithsonian Institution and the Atlantic cable companies in 1873, by which free telegraphic transmission of astronomical discoveries was granted between Europe and America, has been continued during the past year.

The following is a list of the small planetoidal bodies discovered in 1877:

Number.	Name.	Discovered—	By—	At—
170	Myrrha	Jan. 10, 1877	Perrotin	Toulouse.
171	Ophelia	Jan. 13, 1877	Borelly	Marseilles.
172	Baucis	Feb. 5, 1877	....do	Do.
173		Aug. 2, 1877	....do	Do.
174		Sept. 2, 1877	Watson	Ann Arbor.
175		Oct. 1, 1877	....do	Do.
176	Iduuna	Oct. 14, 1877	Peters	Clinton.
177		Nov. 5, 1877	Paul Henry	Paris.
178		Nov. 6, 1877	Palisa	Pola.
179		Nov. 11, 1877	Watson	Ann Arbor.
180 (?)	Eva (?)	Dec. 29, 1877	Palisa	Pola.

NOTE.—*Lumen* (141) was independently discovered by Watson and Borelly in August, and *Athor* (161) by Palisa in October.

EXCHANGES.

The literary and scientific exchanges inaugurated by the Institution have increased during the past year in a greater ratio than ever before. Four hundred and six boxes, averaging 7 cubic feet each, with a total weight of nearly 100,000 pounds, and containing over 15,000 separate parcels, were sent abroad by the Institution. During the year, 4,870 packages, each containing several articles, have been received from abroad for distribution in this country.

To show the high estimation in which this branch of the operations of the Institution is held, as well as to give proper credit to the parties who forward free of charge the packages of the Institution, we republish, as usual, the following list:

Cunard Steamship Company.
Anchor Steamship Company.
Pacific Mail Steamship Company.
Panama Railroad Company.
Pacific Steam Navigation Company.
New York and Mexico Steamship Company.
New York and Brazil Steamship Company.
North German Lloyd Steamship Company.
Hamburg American Packet Company.
North Baltic Lloyd Steamship Company.
Inman Steamship Company.

The special thanks of the Institution are again tendered to the above-mentioned companies for their enlightened liberality.

We may also mention as an evidence of the high appreciation of the character of the Smithsonian exchanges, that the packages bearing the marks of the Institution are admitted free of duty into all foreign ports

The following are the principal foreign agencies of reception and distribution of the Smithsonian exchanges:

London, William Wesley, 28 Essex street, Strand.
Paris, G. Bossange, 16 Rue du 4 Septembre.
Leipsic, Dr. Felix Flügel, 49 Sidonien Strasse.
St. Petersburg, L. Watkins & Co., 10 Admiralty Place.
Amsterdam, Frederick Müller, Heerengracht KK. No. 130.
Milan, U. Hoepli, 591 Galeria Cristoforia.
Harlem, Professor von Baumhauer.
Christiania, Royal University of Norway.
Stockholm, Royal Swedish Academy of Sciences.
Copenhagen, Royal Danish Society.
Lisbon, Polytechnic School.
Madrid, Royal Academy of Sciences.
Havana, Dr. Felipe Poey.
Santiago, University of Chili.
Mexico, Mexican Society of Geography and Statistics.
Montreal, Geological Survey of Canada.

The packages of the Institution for the West Indies have been kindly forwarded by Mr. Thomas Bland, of New York, and those for Turkey, by Messrs. Chrysoveloni & Co., of 5 Fenwick street, Liverpool, England; and those for other points in the East, by the American Board of Commissioners for Foreign Missions, Boston.

The following table exhibits the number of foreign establishments with which the Institution is at present in correspondence, or, in other words, to which it sends publications and from which it receives others in return.

Foreign institutions in correspondence with the Smithsonian Institution.

Algeria	6	Italy	187
Argentine Republic	14	Japan	6
Australia	32	Java	5
Belgium	113	Liberia	1
Bolivia	1	Mauritius	3
Brazil	10	Mexico	16
British America	20	New Zealand	15
British Guiana	3	Norway	25
Cape Colony	5	Peru	4
Central America	2	Philippine Islands	3
Chili	8	Polynesia	2
China	1	Portugal	32
Colombia	3	Russia	162
Denmark	29	Spain	24
Dutch Guiana	1	St. Helena	2
Ecuador	1	Sweden	21
Egypt	8	Switzerland	73
France	327	Turkey	12
Germany and Austria	661	Venezuela	2
Great Britain and Ireland	368	West Indies	8
Greece	8	General	7
Holland	65		
Iceland	4	Total	2,330
India	30		

Statistics of exchanges sent during the last nine years.

	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.
Number of boxes	112	121	108	179	196	131	208	323	397
Bulk in cubic feet	1,033	1,189	772	954	1,476	933	1,503	2,261	2,779
Weight	23,376	31,383	28,950	26,850	44,236	27,990	45,300	80,750	99,250

To facilitate the business of the exchanges, the following rules have been adopted:

1. Every package, without exception, must be enveloped in strong paper, and secured so as to bear separate transportation by express or otherwise.

2. The address of the institution or individual, for whom the package is intended, must be written legibly on the cover, and the name of the sender on one corner of the same.

3. No single package must exceed half of a cubic foot in bulk.

4. A detailed list of addresses of all the parcels sent, with their contents, must accompany them.

5. No letter or other communication can be allowed in the parcel, excepting such as relates exclusively to the contents of the package.

6. All packages must be delivered in Washington free of freight and other expenses.

7. Every parcel should contain a blank acknowledgment, to be signed and returned, either through the agent of the Institution, or, what is still better, through the mail, to the sender.

Should returns be desired for what is sent, the fact should be explicity stated on the list of the contents of the package, as, unless these are specifically asked for, they will fail in many instances to be made.

Specimens of natural history will not be received for transmission unless with a previous understanding as to their character and bulk.

8. Unless all these conditions are complied with, the parcels will not be forwarded from the Institution; and, on the failure to comply with the first and second conditions, will be returned to the sender for correction.

A new edition of the list of foreign correspondents of the Institution is now in press and will be distributed to libraries &c., in the course of a few weeks.

EXCHANGE OF GOVERNMENT DOCUMENTS.—In the report for 1875 a full account was given of the system adopted for carrying out the law relative to the exchange of the official publications of the United States Government for those of foreign nations. In accordance with this system, during the past year, 71 boxes of documents were forwarded, the following being a list of the distribution:

International exchange of government publications in 1877.

	Boxes.		Boxes
Argentine Republic	3	Canada	2
Belgium	2	Portugal	2
Brazil	2	Prussia	2
Buenos Ayres	2	Queensland	2
Chili	2	Saxony	2
England	2	Scotland	2
France	3	Spain	2
Germany	2	South Australia	2
Greece	7	Sweden	2
Hayti	3	Switzerland	2
Holland	2	Tasmania	2
Japan	2	Turkey	2
Mexico	2	Venezuela	3
New South Wales	2	Victoria	2
New Zealand	2		
Norway	2	Total	71
Ontario	2		

The expense of boxing, packing, transporting, and payment of agents in connection with the transmission of these governmen t documents has been advanced for two years by the Institution, but it is expected that Congress will reimburse it by an appropriation at the present session.

LIBRARY.

Statement of the books, maps, and charts received by the Smithsonian Institution in 1877, *and transferred to the Library of Congress.*

Volumes:		
Octavo, or less	1,328	
Quarto, or larger	561	
		1,889
Parts of volumes:		
Octavo, or less	1,954	
Quarto, or larger	2,373	
		4,327
Pamphlets:		
Octavo, or less	1,754	
Quarto, or larger	430	
		2,184
Maps and charts		326
Total		8,726

An increase of 1,141 over the year 1876.

List of the more valuable books received in 1877.

From the British Museum, London: Fac-simile of an Egyptian Hieratic Papyrus, of the reign of Rameses III. London, 1876. Oblong Elephant folio.—Fac-similes of Ancient Charters. Parts ii, iii. 1876–1877. Folio.—Catalogue of Sanskrit and Pali books. By Dr. E. Haas. 1876. 4to.—Catalogue of Oriental Coins. Vol. ii. 1876. 8vo.—Catalogue of Greek Coins. Sicily, 1876. 8vo.—Catalogue of the Fossil Reptilia of

South Africa. By R. Owen. 1876. 8vo.—Catalogue of Birds. Vol. iii. 1877. 8vo.

From the Royal Society of Northern Antiquaries, Copenhagen: Antiquités Russes d'après les Monuments historiques des Islandais et des anciens Scandinaves. Vols. i, ii. Copenhagen, 1850–1852. Folio.—Aarboyer for 1875–1876. 7 parts. 8vo.

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LABORATORY.

During the summer the laboratory was closed, Dr. Endlich, the mineralogist of the Institution, having been engaged on the survey under Dr. Hayden. Mr. Fred. W. Taylor of this city occupied the laboratory for some time in the autumn, and made analyses of mineral waters and specimens of ores, &c., which had been sent to the Institution for examination.

As specimens are constantly being received by the Institution from all parts of the country, with the request that a report be made as to their character or constituents, it may be well to call attention to the rules adopted for their examination.

1. *Qualitative* examinations, that is, for determining the constituents of the specimens, are made without charge.

2. *Quantitative* examinations, or the determination of the percentage of the different components of the specimens, can only be made at the expense of the applicant; the charge to be in proportion to the time expended in the work, *e. g.*, from $5 to $50, according to whether it is *partial* (determination of silver, lead, or iron, &c., only), or *full* (determination of every thing).

3. The report of *quantitative* examinations will be given under the name of the *expert* to whom the specimen shall be submitted, and not under that of the Smithsonian Institution.

4. All applications for the determination of specimens must be made by letter, addressed "Secretary of the Smithsonian Institution."

5. The specimens examined, or part of them, will be retained by the Institution.

6. All specimens to be delivered to the Institution free of expense.

NATIONAL MUSEUM.

The National Museum was established by the Government in 1842, at which time it consisted principally of specimens collected by the Wilkes exploring expedition. It was transferred from the Patent Office to the care of the Smithsonian Institution in 1858, where it has been enlarged by all the collections made by exploring and surveying parties of the several bureaus of the War, Navy, Treasury, and Interior Departments, and those of the Smithsonian Institution.

The following report from Professor Spencer F. Baird, assistant secretary, gives an account of the additions to the museum and the various operations connected with it during the year 1877:

REPORT OF PROF. SPENCER F. BAIRD ON THE MUSEUM.

Increase of the Museum.—It was hardly to be expected that the additions to the National Museum in 1877 should compare with those of 1875 and 1876, including, as they did, the results of large expenditures for the purpose of making a suitable exhibit at the International Exhibition of 1876 of the ethnology and of the resources of the United States, as derived from the animal and mineral kingdoms, with their accessories. The reduction in the yield, however, proves to be much less marked than was anticipated; and the aggregate of receipts has been far beyond that of any previous year, with the exception of those mentioned. The number of donors was 342, of donations 489, and of separate packages 815.

As heretofore, the additions to the Museum consisted of five classes: First, those supplied by the different government expeditions, in accordance with the law of Congress. Second, the donations from private individuals, made either spontaneously, or in response to special invitations and requests. Third, the results of exchanges, prosecuted with various establishments or individuals at home and abroad. A fourth

source of supply is from explorations made at the expense of the Smithsonian Institution. A fifth source of increase is from purchase, which, however, is very insignificant, and is principally confined to specimens of animals obtained in market or occasionally a single ethnological implement, offered under specially favorable circumstances. It is in this that the National Museum differs most from establishments of its grade throughout the world, which depend very largely upon purchases to secure desired materials. Here, on the contrary, the space and force at command are all fully required to receive and care for the collections that are continually arriving from the sources referred to.

In view of the limited accommodations for the collections and of the small appropriations for their maintenance, the special efforts toward the extension of the National Museum have been restricted, for the most part, to North America and to the most interesting subject of research at the present day, that of American anthropology. Every possible effort has been made to invite contributions of facts and materials on this subject, and with very gratifying success. The intention of the Smithsonian Institution to publish, whenever the proper means can be obtained, an exhaustive treatise on American archæology, with suitable illustrations, has invoked the co-operation of many persons who desire to see such an end accomplished; and especially as the Institution proposes to give, under each group, an enumeration of the principal articles received, arranged by localities and donors.

Few portions of the country have been without representation in the ethnological donations of the year; although certain regions have been more prolific than others. The largest additions from any one source have resulted from the continued explorations of Rev. Stephen Bowers on the main-land in the vicinity of Santa Barbara, and on the adjacent islands of Southern California; over forty boxes of material having been supplied by him alone. This exploration was made under the auspices of Maj. J. W. Powell, with the co-operation of the Smithsonian Institution. An exhaustive report on the subject will be published by Major Powell, the collections themselves becoming the property of the National Museum.

With the material heretofore gathered in the same region, by Mr. W. G. W. Harford, Mr. W. H. Dall, Mr. Paul Schumacher, and Mr. Bowers himself, it is believed there can never be a better representation of the archæology of the tribes of the California coast than that now in Washington. This embraces a great variety of objects of stone, bone, shell, and wood, representing applications of these substances far in advance of those of any other aboriginal tribes, excepting those of the northwest coast.

The large collections of similar character, made by Mr. Bowers, in 1875, in behalf of Lieutenant Wheeler's survey, have also been transferred, in part, by that office, to the Museum.

From Mr. Lucien M. Turner, late meteorological observer of the signal-

office, at Saint Michaels, Alaska, there has been received a continuation of his extremely important collections of objects manufactured and used by the Esquimaux of Alaska. This collection is especially rich in carvings on bone and walrus ivory, representing scenes and incidents in the life of that people.

The Institution is indebted to Mr. F. Hirst, of Bridger Station, for many interesting articles from the Rocky Mountain region, principally stone implements of various kinds.

Professor Hayden has presented a full series of models of the ancient ruins in New Mexico and Colorado, together with restorations showing what was probably their original character. These have attracted much attention, and the promised continuation of the series affords much satisfaction.

Mr. Frank H. Cushing, assisted by Mr. Henry J. Biddle, of Philadelphia, visited a cave near Hagerstown, Md., and obtained many relics of the aboriginal people who formerly inhabited that vicinity. Numerous implements of stone and bone, articles of pottery, and fragments of the remains of aboriginal feasts, &c., were collected and are now in process of careful investigation.

The most important yields from the shell-heaps of the United States were obtained from the shell-mounds of Mobile, by Colonel Gaines and Mr. K. M. Cunningham, of that city. These consist of numerous articles of pottery, some of them quite peculiar in form, and of a material and ornamentation constituting almost a distinct class in aboriginal ceramics. With these were also various articles of bone, stone, &c., the whole making one of the most important contributions of the kind yet secured by the National Museum.

From numerous localities in the interior have been received single specimens or collections, partly from mounds, partly from graves, and partly from the superficial soil. These will be referred to in more detail in the list of donations. Among the more noteworthy are those presented by Colonel McAdoo and Mr. McKinley, from Georgia; Mr. Perrine, from Illinois; Mr. Brodnax and Dr. James, from Arkansas; Mr. Illigg and Mr. Berlin, from Pennsylvania, and others.

A great many possessors of rare and curious objects, indisposed to part with them permanently, have freely lent them to the Institution, for the purpose of having copies made, and several persons have been occupied during a great part of the year in making plaster casts and in painting them from the originals before their return.

A collection of implements received from Mr. Berlin, of Reading, is of peculiar interest as representing, in all probability, the same palæolithic epoch as that which Dr. Abbott has so ably discussed in his paper on the Antiquities of New Jersey, published in the Report of the Smithsonian Institution for 1875.

A most valuable addition to the ethnological collection consisted of a series of casts of the heads and faces of sixty-four Indians, held as pris-

oners of war at Saint Augustine, in Florida, under the charge of the War Department. These were prepared during the summer by Mr. Clark Mills, the well-known sculptor, of Washington, who visited Saint Augustine for the purpose. It is generally difficult to induce an Indian to submit to the discomfort and apparent danger of the treatment required in taking face casts, but these prisoners were easily persuaded by Captain Pratt, United States Infantry, who has them in special charge, to allow the operation, and Mr. Mills was extremely successful in the work. In addition to the heads, a number of separate casts of arms, legs, and busts were taken, thus furnishing a rare opportunity for studying the anatomy of the Indian. The tribes represented are the Kiowas, Comanches, Arapahoes, &c. This collection furnishes not only the means of studying the lineaments of the North American Indian, but also answers the purpose of models for lay figures on which to place the many suits of Indian clothing in possession of the Museum.

Extremely important additions have been received from several of the West India islands during the year, some of them unique and previously more or less unknown. Reference has been made in previous reports to the extremely rich collection of stone implements bequeathed to the National Museum by Mr. George Latimer, and of which an illustrated account by Professor Mason is published in the Smithsonian Report for 1876. Among articles of West Indian archæology received in 1877 are several wooden stools of peculiar shapes, highly ornamented and carved, presented by Dr. William M. Gabb and Mr. Frith; some wooden idols of large size and complex shape, also from Dr. Gabb; a stone celt, with the handle and cutting portion in one piece, from Mr. George J. Gibbs; a stone celt inserted in its original handle, by Mr. Murphy, and a number of specimens of somewhat similar character, belonging to the public library of Nassau, and lent for the purpose of being figured and copied. Some collections of a similar character made by Mr. Frederick A. Ober in Dominica, Antigua, and elsewhere, have not yet come to hand.

Other extra-limital collections received have been a series of very interesting articles of obsidian and stone from the National Museum of Mexico, and some ancient Japanese stone implements from the Tokio Museum in Japan.

Of mammals quite a number of specimens have been received, the most striking of them being a pair each of the blue and white foxes of Saint Paul's Island, Alaska, from the Alaska Commercial Company; the skin of a cinnamon bear, from Mr. F. O. Matteson; skins of antarctic seals, from Captain Fuller; and a skeleton of a porpoise of the genus *Tursiops*, new to the Museum, from Mr. Alfred N. Lawrence; two skeletons of the grampus, from Mr. Small, of Provincetown; alcoholic specimens of Platypus and Echidna from Tasmania, &c.

The collections of birds and their eggs received during the year have been quite abundant, the most noteworthy among them being a speci-

men of the everglade kite of Florida, from Mr. George A. Boardman. Dr. James C. Merrill, assistant surgeon, United States Army, has contributed a large collection of birds and eggs from the Lower Rio Grande, several of them new to science, and others not previously known within the limits of the United States. Mr. Lucien M. Turner and Mr. Nelson, of the United States Signal Service, stationed at Saint Michaels, in Alaska, have also sent in large numbers of the birds of Alaska, including many very rare skins.

A series of the birds of Southern Illinois has been received from Mr. Robert Ridgway. Colonel Brackett and Mr. Hirst have furnished some valuable specimens of birds and eggs from Wyoming. From Lieutenant Wheeler and Dr. Hayden have also been received large numbers of specimens collected in the course of their respective surveys.

The National Museum of Mexico has supplied a large number of species from that country, several of them not before in the collection.

Perhaps the most important contribution of birds is that received from Frederick A. Ober, as the result of the exploration he is now making in the West Indies under the direction of the Smithsonian Institution. These were principally obtained from the island of Dominica, and constitute by far the largest series ever gathered in that island, several representing new species and others previously lacking in the Museum. Mr. Ober is still in the field, and additional contributions from the other West India islands are expected.

The collections of reptiles have consisted in large part of the specimens obtained under the direction of Lieutenant Wheeler and Professor Hayden, and transmitted by those officers. The other additions have consisted principally of turtles and snakes, forwarded at the express request of the Institution, to serve as models in the series of plaster casts now in preparation for the Museum. The more important contributors in this line are Mr. S. N. Ferguson, of the large alligator snapper of the Lower Mississippi; Mr. Kohn, of the turtles in the vicinity of New Orleans; Dr. Merrill, of those from the Rio Grande; Mr. Richard, of those from Pennsylvania, &c.

A very large living diamond rattlesnake was obtained through the assistance of Mr. Way, of Sanford, Fla.; and Mr. Frank W. Heyward, of South Carolina, supplied a number of living specimens of *Siren*.

Of fishes the collections have been very large, embracing, of course, those gathered by the United States Fish Commission during its labors in different portions of the country. The summer's work of the Commission was prosecuted on the coasts of Massachusetts and of Nova Scotia, and in the intermediate seas, extending over the months of July, August, and September. Quite a number of fishes not previously described in the fauna of the country were obtained. Many species in large quantities were gathered to serve the purposes of distribution to museums of the United States.

The collections of marine invertebrates, gathered under the same aus-

pices, are also very large. Other collections made by the commission consisted of series of the fresh-water fishes of the Columbia and Clackamas rivers of Oregon, and the McCloud River of California, gathered by Mr. Livingston Stone; of landlocked salmon and other fishes of Grand Lake Stream, Maine, by Mr. Charles G. Atkins; and a great variety of sea-fishes from Wood's Hole, Massachusetts, by Mr. Vinal N. Edwards, and of the Saint John's River, Florida, by Messrs. Baird and Milner.

A large number of the stomachs of mackerel, collected by Capt. H. C. Chester, furnished the means of solving an important problem in regard to the food of that fish. Collections were also made at various points by Mr. Milner and his assistants of the Commission. Mr. Samuel Powel, of Newport, who has been engaged for several years in collecting the fishes of his vicinity, has added many specimens to those already presented by him to the museum, and furnished much information in regard to the geographical distribution of species.

Captain Hulbert, who was engaged as pilot on the Speedwell during her summer's cruise, obtained and transmitted a new species of chimæra, which is now named *C. plumbea* by Professor Gill. This was taken on a halibut line, at a depth of several hundred fathoms, off the coast of Nova Scotia.

Mr. E. G. Blackford, the well-known fish-dealer of Fulton Market, New York, has continued his valuable contributions, that have now extended over a number of years, securing and supplying to the museum all the rarer and more remarkable fishes received by the New York dealers. A large number of specimens have been sent by him, as enumerated in the list of donations, and furnishing a continued illustration of that public spirit, liberality, and disinterestedness for which we are happy to make a public acknowledgment.

Many specimens of various food-fishes, as salmon, trout, whitefish, and the like, have been sent by different contributors for the purpose of meeting an expressed want or of securing identification.

A very interesting series of contributions during the year has consisted of specimens showing the success of the various efforts made under the direction of the United States Fish Commission for the propagation of food-fishes and their introduction into new waters. Among these may be mentioned a full-grown, true shad caught in the Ohio River at Louisville, being one of six hundred taken during the summer under similar circumstances. These were probably derived from the stock introduced four years previously as young fish into the Allegheny River in Western New York. This was presented by the fish commissioners of Kentucky through Mr. Pack Thomas.

A shad, also the result of the transfer of young fish to California several years ago from the East, was furnished by Mr. Bassett, through Mr. B. B. Redding. The latter gentleman also supplied several specimens of the food-fishes of the Sandwich Islands, of which living specimens

had been transmitted to the commissioners of California for introduction into that State.

A salmon, of about twelve pounds weight, caught in the Delaware River, at Easton, in October, was supplied by Mr. Howard J. Reeder, fish commissioner of Pennsylvania. This was supposed to have been derived from a stock introduced into the river in 1873.

Many other equally interesting cases will be found referred to in the list of donations, and more especially in the report of the United States Fish Commissioner for 1877.

A finely-stuffed skin of the adult Ontario salmon was presented by Mr. Samuel Wilmot, of the Canadian fishery department, at New Castle, Ontario. This was a female, and especially interesting as having furnished a quota of eggs during three successive seasons.

In consequence of an extended exploration of the rivers of Georgia, the Carolinas, &c., prosecuted by Prof. D. S. Jordan, during the last summer, in part under the auspices of the United States Fish Commission, large numbers of species of fish, several of them previously undescribed, were collected, and a series transmitted by Mr. Jordan.

Collections of the fishes of the Great Basin, and of the coast of California, were received from Lieutenant Wheeler, as the result of his gatherings in past years.

Of extralimital species, the most important collection of fishes was one received from Mr. G. Brown Goode, assistant curator of the National Museum, gathered by him during the past winter in Bermuda. Some species from the vicinity of the Kerguelen Islands were presented by Captain Fuller.

Of marine invertebrates, the principal collections were those made by the United States Fish Commissioner. Some of great interest were obtained from Col. E. Jewett, of Santa Barbara, Mr. James G. Swan, in Washington Territory, and others.

The collections of plants were not very extensive; the most important, however, were furnished by Lieutenant Wheeler. A valuable contribution consisted of a series of specimens of Japanese woods, representing fifty species, and presented by the Tokio Museum of Japan. These, taken in connection with fifty other species received by the Smithsonian Institution from the Japanese commission at the Centennial Exhibition, complete the series of woods of Japan.

Fossil remains of more or less rarity and interest are represented by a collection of the Black Hills fossils, gathered by Prof. Henry Newton, whose untimely death science has reason to deplore. To this is to be added a series from Illinois, collected by Mr. George Spangler.

Numerous collections of minerals have been added to the museum; but, for the most part, necessarily stored with the other accumulations for the want of a proper opportunity of exhibition. The most important of these consists of a collection illustrating the iron and steel manufactures of Sweden. This constituted the exhibit of that government at

the exhibition at Vienna, in 1873. It was presented by the commissioner, Mr. Daunfeldt, to the Philadelphia Centennial Commission, but was not exhibited, having been stored in Philadelphia until the past summer, when it was presented by the Centennial Board of Finance to the United States.

This exhibit was quite equal in value to that displayed by Sweden at Philadelphia, and which became the property of the Institute of Mining Engineers. The collection, amounting to about fifteen tons in weight, was carefully packed under the supervision of Mr. Thomas Donaldson, and forwarded to the Institution.

Messrs. Dunn & Brothers, of Philadelphia, presented three boxes of China clay from an establishment in England, of which they are the agents.

Surveyors-General Wasson and Hardenburg have continued their contributions of specimens illustrating the character of the ores in newly-discovered mining regions in Arizona, &c. Mr. C. W. Derry presented a collection of silver ores from the J. D. Dana Mine in Colorado. Mr. Reynolds, the United States minister to Bolivia, has transmitted a series of copper ores of that country, and a large number of single specimens have been received, sent in for the purpose of identification.

It will be seen, from the preceding enumeration and from the list of donations, that the collections are of varying magnitude, some being exhaustive and covering all branches of natural history, others limited to a single department and sometimes to a single specimen. All these, however, find their place, a single object sometimes being more valuable than a large collection in supplying an important gap.

The most important sources of supply, as will be understood from what has already been said, have been the several government expeditions, particularly those of Lieutenant Wheeler and of Major Powell; the articles of general and natural history and ethnology obtained from these two officers being of very great magnitude and value.

The thanks of the Institution are due for 1877, as in previous years, to the Alaska Commercial Company, for disinterested and important services in acting as its agent in receiving and forwarding specimens and supplies transmitted between the Smithsonian Institution and its correspondents on or near the Pacific coast of North America and Asia; in giving free transportation on its vessels to their correspondents and their equipment and collections, as well as subsistence and quarters at its stations; in supplying objects of natural history, valuable in a scientific point of view as well as commercially; and in every possible way giving to the Smithsonian Institution the benefit of its organization and opportunities in the most liberal manner, and, in all cases, without any charge beyond that required for the reimbursement of moneys actually paid.

The United States Signal Service, under General Myer, has taken part, with its usual liberality, in the efforts of the Institution to in-

crease the knowledge of the natural history of North America, by allowing it to nominate observers at several of its Northwestern posts, who possessed the necessary interest and skill to make collections and observations. Noteworthy among these are Mr. Lucien M. Turner, for several years stationed at Saint Michaels, in Alaska, and his successor at that post, Mr. E. W. Nelson.

Single collections have been received from time to time from other observers in the service. Reference has been made to Dr. J. C. Merrill, of the United States Army, who made collections on the Lower Rio Grande, in the vicinity of Brownsville. This gentleman has enabled us in great measure to complete the work begun years ago by Dr. Berlandier, and continued by Lieut. D. N. Couch, Gen. Stewart Van Vliet, Mr. J. H. Clark, Mr. Arthur Schott, and other members of the Mexican Boundary Survey. Although but a short time resident at Fort Brown, Dr. Merrill has already made a great many important additions to the known fauna of that region. In this he has been aided by Mr. George B. Sennett, of Erie, Pa., who has also rendered valuable service to science.

To Mr. F. Hirst, of Bridger Station, Wyo., we owe many important contributions of birds, eggs, ethnological specimens, &c. Col. A. G. Brackett, U. S. A., also stationed in Wyoming, has likewise been a valued contributor.

Mr. Livingston Stone has added greatly to our knowledge of the fishes and ethnology of Oregon and California, by his collections in connection with the operations of the United States Fish Commission.

Lieutenant Wittich has also contributed toward the same end in Oregon. Mr. James G. Swan, for many years a collaborator of the Institution, and who, in 1875 and 1876, transmitted such extensive collections of ethnologica for the Centennial Exhibition of the Indian Bureau, has also made large contributions of various objects, during the year, from Puget Sound.

The sea-coast has been well explored by the United States Fish Commission on the coasts of Massachusetts and Nova Scotia, while the fishes of Narragansett Bay and vicinity have been investigated by Mr. Samuel Powel, of Newport.

The collections of birds and ethnologica from the National Museum of Mexico have been already adverted to, and relations have been established between the national museums of the two countries, which we hope will tend to their mutual benefit.

The residence of Mr. G. Brown Goode in Bermuda during the winter of 1876, has been productive of very desirable results; full series of the fishes, invertebrates, corals, &c., having been gathered.

The attention of the Smithsonian Institution has for many years been directed toward a thorough investigation of the natural history and ethnology of the West India Islands, and extensive explorations and collections have been effected through its agency in past years, in

the Bahamas, Jamaica, Cuba, Hayti, St. Domingo, Porto Rico, St. Thomas, Santa Cruz, and Antigua; thus covering very largely the western portions of the group, or the Greater and Lesser Antilles.

For the purpose of obtaining at least a general idea of the other islands more eastward, and of having them represented in the National Museum, the Smithsonian Institution, in the fall of 1876, made an engagement with Mr. Frederick A. Ober to proceed to that region, and, if possible, visit every island, large and small, occupying several years in the labor. The islands of Dominica, St. Vincent, Barbuda, Antigua, &c., have been explored by Mr. Ober up to the present date.

The subjects to which his attention was especially called were the archæology and ethnology of the islands, and their vertebrate animals. He has succeeded in finding remnants of the ancient Carib tribes, especially in Dominica, and has obtained numerous photographs of the people and specimens illustrative of their handiwork. His collections of birds have also been very extensive, embracing several undescribed species, and others of great rarity, or not previously represented in the National Museum.

Reference has been made, in previous reports, to the large collections made at the Kerguelen Islands by Dr. J. H. Kidder, while connected with the Transit of Venus Expedition. Some important deficiencies of specimens, however, not procurable during Dr. Kidder's visit, have been obtained, at his request, by Captain Fuller, of the merchant service, and presented to the Institution.

Scientific investigation of the collections.—As in previous years, the collections of the National Museum have been freely intrusted to competent naturalists for investigation and description; and much has been accomplished toward their proper classification and identification. Specimens of certain groups of mammals have been intrusted to Dr. Elliot Coues, of the United States Army, and Mr. J. A. Allen, of Cambridge, who are preparing a series of monographs for publication, under the direction of Dr. Hayden. A magnificent quarto by these two gentlemen, forming volume xi of the Reports of the Government Surveys of the Territories, and occupying 1100 pages, is devoted exclusively to the Rodentia, the materials derived almost entirely from the National Museum.

Other important monographs on the fur-bearing animals and on the insectivora have been likewise prepared by them.

The birds of America outside of the United States, and those of the West Indies, have been placed in the hands of Mr. George N. Lawrence who has published a number of papers upon them, describing several new species, principally from the collections of Mr. Ober and of Mr. Brace, of Nassau. Mr. Ridgway, the assistant in charge of the department of ornithology in the museum, has made investigations into the scientific relations of the raptores, the herons, &c., and published several monographs.

The reptiles have been placed in the hands of Prof. E. D. Cope for investigation.

The fishes have been elaborated by Prof. Theodore Gill, Mr. G. Brown Goode, Dr. T. H. Bean, and Professor Jordan. The latter gentleman has prepared some important monographs relating to the fresh-water fishes of the United States from the specimens of the National Museum, describing many new species.

Mr. William H. Dall has had charge of the Mollusca, and has described some new species. Others have been submitted to Mr. Thomas Bland.

The marine invertebrates collected by the United States Fish Commission are in the hands of Prof. A. E. Verrill, of Yale College, the special collaborator of the Commission. In their examination he has been assisted by Prof. Sidney I. Smith, of the same institution. Extensive monographs are in preparation by them, to be published by the Commission.

The sponges have been sent to Professor Hyatt, of Boston, our chief authority on that subject.

The fossil invertebrates have been investigated by Prof. C. A. White, the palæontologist of Dr. Hayden's survey.

In accordance with an arrangement of several years' standing, the collections of all vegetable substances, and of insects, have been transferred, as received, to the Department of Agriculture, and these have been properly elaborated by the officers in charge of the several departments of its museum.

The ethnological specimens have been studied carefully by Dr. Rau and Mr. Cushing, in charge of the department of the ethnological collection, Prof. O. T. Mason, and others. Professor Mason has published a paper, with numerous illustrations, upon the collections from Porto Rico, in the Smithsonian Report for 1876.

Work done in the museum.—The force in the museum occupied in the arrangement of the collections was necessarily diminished on account of the reduction of the Congressional appropriation, but all those retained have been diligently occupied in cataloguing the collections, in preparing and arranging them for exhibition, and in identifying and describing them.

As will be seen by a table in the appendix, the total number of entries of specimens during the year amounted to 11,398. Although this is not quite equal to the number recorded in 1876, it is considerably in excess of the receipts of any previous year.

The labor of receiving the specimens, ascertaining their exact origin, distributing them among the various departments, giving to them the treatment necessary for their permanent preservation, and finally their identification and entry, and deposit in a suitable place, is very great; no single day passing without some fresh addition of material requiring all these precautions. It is, however, believed that the National Museum will compare favorably with any establishment of its kind in the accomplishment of this necessary work with its actual force.

Distribution of duplicate specimens.—A very large portion of the labor during the year has been directed toward the selection and labeling, recording and packing, of duplicate specimens for distribution, in accordance with the act of Congress providing for the same.

In addition to a large number of single specimens or small series, supplied as the result of special application, a number of collections have been prepared embracing many extremely rare and desirable objects. Among the most important of these may be mentioned twenty-five sets of fishes, each containing seventy-five to one hundred and fifty species. These have been carefully identified and labeled, under the supervision of Professor Gill and Dr. Bean, and have constituted extremely acceptable additions to the museums to which they have been sent.

Other series of magnitude consist of birds' eggs, shells, bird-skins, &c.

A large number of series of diatomaceous earths have also been supplied, embracing forty or fifty different localities, many of them unknown to the investigator. The demand for them is very great, and taxes the ability of the person in charge to meet it.

Necessity of increased accommodations for the museum.—The necessity for more space has already been adverted to in the report for 1876, where full details will be found on the subject. It may be only necessary here to say that the exigency is greater than ever, in view of the largely-increased collections of the year and the deterioration caused to the animal and metallic specimens in consequence of their being boxed up and out of the reach of proper care. Very serious losses have already been experienced in the collections of wools, animal fibers, &c., and from the rusting of the specimens of iron and steel, and it is earnestly hoped that the next report may chronicle the initiation of measures by Congress for relief in this direction.

At present it is reasonable to estimate that the articles worthy of exhibition, but withdrawn from view, are several times greater in extent than those at present displayed, and that a correspondingly enlarged building is required for their display.

The collections thus withdrawn from exhibition consist not only of those most interesting to the naturalist, but also of such as are of the highest industrial value to the country, and will add greatly to the means of technical instruction, embracing as they do illustrations of different kinds of building-stone, ores of all kinds, earths, china and porcelain clays with the products derived from them, illustrations of the animal products of the country in the way of furs, oils, gelatines, glues, fibers, hair, bristles, chemical products, &c., and a great variety of articles to which reference is made in the report for 1876.

FISH CULTURE.

The labors of the United States Fish Commission, under Professor Baird's direction, have been prosecuted through the year with very satisfactory results.

As in previous years, the operations have been carried on under two distinct divisions: first, the inquiry into the condition of the American fisheries; and secondly, the multiplication of useful food-fishes in the rivers and lakes of the United States.

The first division embraces a critical examination into the physical and biological character of the waters, such as the determination of their temperature in different seasons, their currents, their chemical composition, the character of the bottom, and the precise nature of the animal and vegetable life occurring therein, with their mutual relations; as also the influences which may tend to affect the abundance and the distribution of the fish in different seasons, whether by natural causes, artificial impediments or obstructions, or by excessive fishing. Work in this direction has been conducted since 1871, and has resulted in supplying a minute and satisfactory knowledge of the character of the coast and off-shore portions of the United States, from the Bay of Fundy to Long Island Sound, and other portions of the sea-coast and of the lakes have been investigated in a less elaborate manner.

The operations in regard to the propagation of food-fishes relate especially to the introduction of California salmon, Atlantic salmon, land-locked salmon, and whitefish into new waters, or their multiplication in those that have been depleted. Special attention, also, in later years, has been directed to the European carp, a well known and favorite domesticated fish, and promising to be an important addition to the food resources of the United States.

The usual operations of the Fish Commission, in its maritime work during 1877, were somewhat modified by the attendance of Professor Baird on the International Fishery Convention on the part of Great Britain and the United States, at Halifax, by the request of the Secretary of State.

Under the law of Congress, which directs all needed aid to be furnished, as far as practicable, to the United States Fish Commission in its varied operations, by the executive departments of the government, the Secretary of the Navy has for several years supplied a steamer, completely equipped for use, and in the season of 1877 a much larger vessel than usual was detailed at the request of the Secretary of State; this was the tug Speedwell, an iron propeller of 310 tons and of great stanchness, and thoroughly fitted for her work. She was equipped for the special service at the navy-yard in Portsmouth, N. H., under the direction of Commodore Guest, and the scientific apparatus formerly used on board the United States steamer Blue Light was transferred to her at New London. She was commanded by Lieutenant-Commander A. G. Kellogg, with Dr. T. H. Sheets as surgeon, and Mr. A. V. Zane as engineer. The vessel reported for duty on the 31st of July, at Salem, at which point Professor Baird had been stationed for a month, engaged in the preliminary work of the commission prior to proceeding to Halifax. This consisted, in part, in the collection of statistical information

in regard to the present condition of the American fisheries, for which purpose circulars were printed and distributed very extensively along the coast, and several competent agents were detailed for making the necessary inquiries.

As in previous years, Prof. A. E. Verrill, of Yale College, assisted by Mr. E. B. Wilson, took special charge of the investigations in regard to the marine invertebrates, while Mr. G. Brown Goode and Dr. T. H. Bean discharged a similar relation to the vertebrates. A number of trips were made by the vessel from Salem, which resulted in the discovery of some new and extensive fishing-grounds of much value, which it is believed will in time be utilized in the interest of the American fisheries.

Professor Baird proceeded to Halifax about the middle of August, where he was joined by the Speedwell on the 22d, from which point a new series of researches was carried on tending to still further elucidate the fisheries of the United States and of the British possessions.

The opportunity furnished by the presence of many intelligent fishermen and other witnesses called on both sides by the convention, was embraced by Professor Baird to secure information in regard to the condition, extent, and location of the American fisheries and the details of their prosecution, and enabled him to collect material for an exhaustive work on the subject, to be published at some future time in the report of the commission.

Professor Baird's duties in Washington required his return from Halifax a short time before the close of the convention, and he left on the 20th of October for home, the steamer Speedwell having proceeded to Salem on the 13th; and, after remaining a few days and carrying on some investigations in regard to the habits and distribution of the sea-herring, she reported herself at Portsmouth and was taken out of com mission.

The season of 1877 was unusually productive in the increase of our knowledge of the natural history of the coast; a number of species having been added to previous lists, a considerable proportion new to science.

The work of the commission in the direction of the propagation of food-fishes began in April with the shad, an establishment having been formed at Havre de Grace, in the Susquehanna, where 11,000,000 of young shad were hatched out and distributed throughout the United States. During this season an entirely new system of hatching shad, invented by Mr. T. B. Ferguson, fish commissioner of Maryland, was put into successful operation. In this the necessary motion required by the eggs is imparted by steam machinery, which causes a cylindrical vessel in which the eggs are placed to rise and fall in the water with a proper degree of velocity. In this way many practical difficulties in the hatching of shad in open bays and elsewhere are overcome.

The work of hatching shad at Havre de Grace was prosecuted with the assistance of Mr. Ferguson, while the shipment and distribution of

the young fish was directed by Mr. J. W. Milner, Assistant United States Fish Commissioner.

After completing operations at Havre de Grace, the commission, under Mr. Milner, transferred its operations to Holyoke, in Massachusetts, which resulted in about the average success.

The yield of eggs of the California salmon from the United States establishment situated on the McCloud River, in Northern California, was not so large as usual, in consequence of the interference with the upward run of the fish by some canning establishments on the Lower Sacramento. Between five and six millions of eggs, however, were secured and duly distributed. These were sent to all parts of the United States, as also to Canada, Australia, New Zealand, the Sandwich Islands, Germany, France, England, and the Netherlands.

Nothing was done during the year with the Atlantic salmon, although the establishment at Bucksport was kept in repair.

Unusual success was experienced in the collection of eggs of the landlocked salmon in the Grand Lake Stream in Eastern Maine, about two millions having been secured and distributed to fish commissioners and other parties in a large number of States. This work was prosecuted in co-operation with the fish commissioners of Massachusetts and Connecticut, who bore a share of the expense.

In the early part of the year Mr. Rudolph Hessel, an experienced fish culturist, was sent to Germany to obtain a supply of the German carp, and he brought back several hundred of the best varieties. These were placed temporarily in certain ponds in Druid Hill Park, Baltimore, under the care of Mr. T. B. Ferguson.

For the further treatment of these fish, and the multiplication of sufficient numbers to commence distributing them throughout the United States, Congress, in the latter part of the year, granted to the commission the use of the ponds on the Monument lot, in the city of Washington, and made an appropriation to fit them up properly. Work has been begun upon these ponds, and it is hoped that in the course of the year 1878 a successful beginning may be made in the way of distribution of fish from them.

The labors of the United States Fish Commission can scarcely be too highly estimated. A very large and increasing portion of human life is sustained by the product of the water, especially of shores and rivers. Organic matter necessary to the sustentation of life is produced by radiation from the sun in connection with plants, but a large portion of this is carried into the waters of rivers and that of the sea, by sewage and drainage, and can only be reclaimed for human use by the production of fishes. Hence, with the increase of population of civilized countries, the art of breeding and catching fish becomes as important, almost, as the extension of arable land and the improvement of agriculture. Indeed, it becomes in some respects more valuable than these, since it supplies food differing from that of the land; and, therefore, adds to the variety of the means for gratifying the palate.

The improvement which has been made in the art of producing fish is truly wonderful. Rivers, ponds, and lakes which are almost entirely barren or inhabited only by fish of but little value may be filled to repletion and kept full by judicious arrangement of the time of catching. The rules, however, for the art of fish culture are founded on scientific observations relative to the natural history of fish, and especially in regard to one principle, namely: that nature, to preserve a species, is prodigal in the production of individuals. This is especially true in regard to fishes; for example, from a single shad may be stripped 10,000 eggs which, being left exposed to all the enemies to which they are subjected, will yield not more than 50 young individuals able to feed themselves, and not more than 5 adult fish capable of reproduction, while the same number of eggs hatched by artificial means ought to yield 9,500 young fish, with a reasonable expectation of 950 adults.

The subject of fish culture has, however, but lately attracted the attention of the general government, the first small appropriation in regard to it having been made in 1872. It has, however, been extended year by year by small additional appropriations, and has now attracted such attention that the country will demand a still wider extension of its labors.

In this connection I would draw attention to the immense importance of the National Museum as an educational establishment. Specimens of every variety of fish in the different waters of the United States are sent by the employés of the Fish Commission to Washington in a fresh condition, and from them molds are immediately made in plaster from which again models are cast and painted to give exact representations in form and color of the original specimens. In this way in the course of a limited time a full set of all the edible fish of North America will be obtained, as well as models of those of a similar character from other countries. In addition to this, the National Museum has now in its possession ready for exhibition when a new building shall be provided, specimens of all the apparatus used in all the different countries of the world for the capture and utilization, as well as the propagation of fish.

The importance of such a collection as a means of diffusing and improving practical ideas can scarcely be too highly estimated.

CONCLUSION.

It will be seen from the report of Professor Baird that a large amount of his time has been expended in labor for the general government, in relation to American fisheries.

Almost from the first organization of the Institution until the present time the officers of the Institution have rendered service to the general government without additional salary. For several years past the Secretary has devoted the greater part of the summer to investigations on sound in its application to fog-signals, in connection with the Light-House Board.

These investigations have been made along the coast on light-house steamers, with the assistance of members and officers of the light-house establishment. During the last year a series of experiments were made along the coast of Maine, which served to establish some new principles, as well as to confirm previous results.

From all the experiments which have been made by the Light-House Board in regard to the transmission of sound in free air and those derived from other observations which can be fully relied upon, the following conclusions may be considered established, subject, however, to such further modification and extension as subsequent investigation may seem to indicate:

"1. The audibility of sound at a distance (the state of the atmosphere being constant) depends upon the character of the sound. The distance through which a sound may be heard is governed by the pitch, the loudness, and the quantity of sound. The pitch or frequency of the impulses in a given time must not be too high, otherwise the amplitude of vibration will be too small to allow a sufficient quantity of air to be put into motion; neither must the pitch be too low, for in this case the motion of the atoms of air in the sound-wave will not be sufficiently rapid to convey the impulse to a great distance. Again, the greater the loudness of the sound, which depends upon the amplitude of the vibrations of the sounding body, the greater will be the distance at which it will be heard. And finally, the greater the quantity of sound, which depends upon the magnitude of the vibrating surface, the greater will be the distance to which it is audibly transmitted. These results are derived from observations on the siren, the reed-trumpet, and the automatic buoy. The effect of quantity of sound is shown in the fact that in sounding different instruments at the same time, it was found that two sounds apparently of the same loudness were heard at very different distances. The audibility of sound depends upon the state of the atmosphere.

2. A condition most favorable to the transmission of sound is that of perfect stillness and uniform density and temperature throughout. This is shown by the observations of Parry and other Arctic explorers; although in this case an efficient and co-operating cause is doubtless the downward refraction of sound due to the greater coldness of the lower strata of air, as first pointed out by Professor Reynolds. Air, however, is seldom in a state of uniform density, but is pervaded by local currents, due to contact with portions of the earth unequally heated, and from the refractions and reflections to which the sound-wave is subjected in its passage through such a medium it is broken up and lost to the ear at a less distance.

3. But the most efficient cause of the loss of audibility is the direct effect produced by the wind. As a general rule, a sound is heard farther when moving with the wind than when moving against it. This effect, which is in conformity with ordinary observation, is not due to

an increase of velocity of the sound-wave in one direction and a diminution in the other by the motion of the wind except in an imperceptible degree; for since sound moves at the rate of about seven hundred and fifty miles an hour, a wind of seven miles and a half an hour could increase or diminish the velocity of the sound-wave only one per cent., while the effect observed is in some cases several hundred per cent. It is, however, due to a change in its direction. Sound moving with the wind is refracted or thrown down toward the earth; while moving against the wind it is refracted upward and passes over the head of the observer, so as to be heard at a distance at an elevation of several hundred feet when inaudible at the surface of the earth.

4. Although, as a general rule, the sound is heard farther when moving with the wind than when moving against it, yet in some instances the sound is heard farthest against the wind, but this phenomenon is shown to be due to a dominant upper wind, blowing at the time in an opposite direction to that at the surface of the earth. These winds are not imaginary productions invented to explain the phenomena, but actual existences, established by observation, as in the case of the experiments made at Sandy Hook in 1874, by means of balloons, and from the actual motion of the air in the case of northeast storms, as observed at stations on the coast of Maine.

5. Although sound issuing from the mouth of a trumpet is at first concentrated in a given direction, yet it tends to spread so rapidly, that at the distance of three or four miles it fills the whole space of air inclosed within the circuit of the horizon, and is heard behind the trumpet nearly as well as at an equal distance in front of its mouth. This fact precludes the use of concave reflectors as a means of increasing the intensity of sound in a given direction; for although at first they do give an increase of sound in the direction of the axis, it is only for a comparatively short distance.

6. It has been established, contrary to what has formerly been thought to be the case, that neither fog, snow, hail, nor rain materially interferes with the transmission of loud sounds. The siren has been heard at a greater distance during the prevalence of a dense and widely-extended fog than during any other condition of the atmosphere. This may, however, be attributed to the uniform density and stillness of the air at the time.

7. In some cases sound-shadows are produced by projecting portions of land or by buildings situated near the origin of the sound, but these are closed in by the spread of the sound-waves, and thus exhibit the phenomenon of sound being heard at a distance and afterwards lost on a nearer approach to the station.

8. It frequently happens that on a vessel leaving a station the sound is suddenly lost at a point in its course, and after remaining inaudible some time, is heard again at a greater distance, and is then gradually lost as the distance is farther increased. This phenomenon is only observed when the sound is moving against the wind, and is therefore

attributed to the upward refraction of the sound-wave, which passes over the head of the observer and continues an upward course until it nearly reaches the upper surface of the current of wind, when the refraction will be reversed and the sound sent downward to the earth; or the effect may be considered as due to a sound-shadow produced by refraction, which is gradually closed in at a distance by the lateral spread of the sound-wave near the earth, on either side, in a direction which is not affected by the upward refraction. Another explanation may be found in the probable circumstance of the lower sheet of sound-beams being actually refracted into a serpentine or undulating course, as suggested in the Appendix to the Report of the Light-House Board for 1875. Such a serpentine course would result from successive layers of unequal velocity in an opposing wind; as being retarded at and near the surface of the earth, attaining its maximum velocity at the height of a few hundred feet, and then being again retarded at greater elevations by the friction of upper counter-currents, or stationary air. In some cases the phenomenon is due to one or the other of these causes, and in other cases to both combined. That it is not due to the obstructing or screening effects of an abnormal condition of the atmosphere is shown by the fact that a sound transmitted in an opposite direction, through what is called the region of silence, passes without obstruction. It is probable, from all the observations, that in all cases of refraction of a sound moving against the wind, it tends again to descend to the earth by the natural spread of the sound.

9. The existence of a remarkable phenomenon has been established, which is exhibited in all states of the atmosphere during rain, snow, and dense fog, to which has been given the name of aerial echo. It consists of a distinct echo, apparently from a space near the horizon of fifteen or twenty degrees in azimuth, directly in the prolongation of the axis of the trumpet. The loudness of this echo depends upon the loudness and quantity of the original sound, and therefore it is produced with the greatest distinctness by the siren. It cannot be due to the accidental position of a flocculent portion of atmosphere nor the direct reflection from the crests of the waves, as was at first supposed, since it is always heard except when the wind is blowing a hurricane.

As a provisional explanation, the hypothesis has been adopted that in the natural spread of the waves of sound some of the rays must take such a curvilinear course as to strike the surface of the water in an opposite direction and thus be reflected back to the station or location of the origin of the sound."

Respectfully submitted.

JOSEPH HENRY,
Secretary Smithsonian Institution.

WASHINGTON, *January*, 1878.

Appendix to the Report of the Commissioner for
1877; p. 55 — Table showing amount of Government
explorations in '77; Table showing Entries in Land Books, Distribution of duplicates, and Gifts & donations &c Remarks. Record of important explorations, principal courses of travel, calculations &c.

REPORT

OF

PROFESSOR SPENCER F. BAIRD,

SECRETARY OF THE SMITHSONIAN INSTITUTION,

FOR

THE YEAR 1878.

WASHINGTON:
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REPORT OF PROFESSOR BAIRD,

SECRETARY OF THE SMITHSONIAN INSTITUTION, FOR 1878.

To the Board of Regents of the Smithsonian Institution:

GENTLEMEN: I have the honor herewith to present the report of the operations and condition of the Smithsonian Institution for the year 1878.

The most important event during that time, and, indeed, in the history of the establishment, is the death of Professor Henry, its lamented Secretary, to whom was intrusted its organization in 1846, and under whose firm and judicious direction it has been carried safely forward, surmounting in its progress many obstacles and trials, to its present condition of efficiency and prosperity.

It is difficult to overestimate the importance to science and humanity of the administration of Professor Henry in this connection. It was a mere chance that the right man for the place would be selected, and whether any other of the candidates would have done equally well it is, of course, impossible to say. It is very certain, however, that the chances would have been adverse to such a result. The most logical methods of operation and research, the strictest economy of administration, the restriction of the Institution to its legitimate functions in the increase and diffusion of knowledge among men, and the avoidance of all entangling alliances of every kind, signally characterized the administration of affairs by Professor Henry for the long period of nearly one third of a century. This time sufficed to impress upon the Institution a definite policy, and one which will, I trust, be permanent. It will certainly be my endeavor, as the successor of Professor Henry, to carry out his principles during whatever period Providence and your good-will may grant me the direction of affairs.

The characteristics of the policy adopted by Professor Henry at the beginning of his administration, and sanctioned by the Board of Regents, were, first, never to attempt to do with the funds and appliances of the Institution what could equally well be done by other appropriate agencies; secondly, to attempt nothing which might not strictly be considered as coming within the department of science, theoretical or applied; thirdly, to keep all expenditures within the income of the Institution, and never to allow the operations of one year to be hampered by indebtedness carried over from the preceding; and, finally, not to restrict the operations of the institution to Washington, or even to the United States; but to extend its benefits to the whole world, in view of the proper inter-

pretation of the will of Mr. Smithson that the main functions of the institution should be "the increase and diffusion of knowledge among men."

Numerous illustrations of the policy of Professor Henry in regard to the first principle adopted by him can be adduced. No matter how favorite the branch of research might have been with him, nor what amount of reputation might be gained to the Institution by prosecuting it, he was always ready to transfer it to those who could carry it on with success. The most noteworthy instance, perhaps, was that in connection with the subject of meteorology, which had from the beginning been one of special interest to him. The very earliest action in the scientific direction of the Institution had reference to the adoption of a general system of meteorological observations throughout the United States and the adjacent portions of America, and the proper reduction of the results in a systematic form. Up to the time of the establishment of the Signal Office, this was by far the most important feature of Smithsonian activity. It embraced a connection with about six hundred observers from all the walks of life and in all parts of the country. With these, constant communication was held, and from them were received monthly detailed observations of various degrees of minuteness and accuracy on blanks furnished to them previously by the Institution; and an extended correspondence was maintained with them, not only on meteorological subjects but upon others of scientific interest. For more than twenty-five years this relation continued with the most important results, the work extending and enlarging year by year in a rapid ratio.

As soon as the operations of the United States Signal Office were established by government, under General Myer, Professor Henry offered to turn over the Smithsonian system with its observers to that establishment, and this offer being accepted the transfer was made; since then the Institution has confined itself to working up the results of a quarter of a century's labors and publishing them in a systematic and digested form. The series of such digests has been nearly completed and the whole will be finished as rapidly as the funds of the Institution will permit.

It was to this restriction of effort to subjects of importance, in a scientific or practical point of view, which were not otherwise provided for, that is due the impression made upon the progress of learning by the Smithsonian Institution as administered by Professor Henry. There are numerous establishments in the United States, not of precisely similar character, but with the same general object, and with equal or larger funds of endowment, but which are scarcely known or even heard of outside of the limits of the city in which they may happen to be situated. The name of the Smithsonian Institution, on the contrary, is a familiar one in every part of the world; and it may almost be said that it is even better understood, comprehended, and appreciated in the remotest parts of Europe than it is in some sections of the United States.

At the beginning of the active operations of the institution, Professor Henry prepared what he called a "Programme of organization." This was first submitted to the judgment of leading men of science throughout the United States and Europe, and received general approval. It was presented to the Board, and adopted as the basis of future operations. It is interesting to note that whatever new lines of research or of practical work have been taken up from time to time by the Institution, were simply the carrying out into practical effect of one or other of the subdivisions of the proposed programme.

The board at its special meeting, held on the 17th of May, 1878, directed the preparation of a suitable biography of its late Secretary, and also the holding of a memorial service in one of the halls of Congress, if it could be obtained for the purpose. The preparation of this biography was intrusted to a committee, consisting of President Porter, of Yale College, Dr. Maclean, of Princeton, and Professor Gray, of Harvard; and it has been prepared by the latter gentleman, and will be submitted by him to the Board.

The arrangements for the memorial services have been made, to take place on the evening of Thursday, January 16, 1879. In addition to the records prepared by the direction of the Board, two other memoirs have been written, and were presented, October 26, 1878, to the Philosophical Society of Washington, of which Professor Henry had been the presiding officer from the time of its organization. One of these memoirs, by Dr. Welling, president of Columbian University, gave an account of Professor Henry's life and character with reference to his personal, social, and educational qualities; and the other, by Mr. William B. Taylor, set forth more particularly his scientific work and the succession of his discoveries.

Professor Henry's last illness dates from the autumn of the year 1877, and was apparently induced in a considerable measure by exposure while carrying on a series of experiments in behalf of the Light-House Board. After his return from Staten Island, he was able to bestow but little attention to the details of the work of the Institution; although, up to the very day of his death, he was directing and controlling it as from the beginning. Shortly after his return in the autumn, he made a visit to Philadelphia, for the purpose of being under the care of Dr. S. Weir Mitchell, and came back to Washington after an absence of a few weeks. His death took place on the 13th of May, 1878,—a peaceful and happy death—surrounded by his family and friends.

After his decease, as in his life, he was signally honored. Congress adjourned to attend the funeral, which was also marked by the presence of the highest dignitaries of the country, including the President and his cabinet, the justices of the Supreme Court of the United States, and those of the District of Columbia, the diplomatic corps, and numerous organizations of which he was a member, as well as others from abroad.

Honored by the Board in being selected to succeed Professor Henry, it was with the greatest diffidence, and with an unaffected distrust in my ability to administer worthily the operations of the Institution, that I accepted the trust. Animated by a desire to secure the continuance of the wise policy inaugurated and maintained by Professor Henry,—by a consciousness of familiarity with the varied duties required,—and by a natural sympathy of purpose resulting from a long association with him—holding steadily before me his example—I venture upon the experiment; hoping only that the contrast of the present administration of the Institution with that of the past will not be too unfavorably marked.

I may, perhaps, be pardoned for calling attention to the fact that my own connection with the Institution and association with Professor Henry dates back to the year 1850, and that consequently, for more than twenty-eight years, I have been engaged in carrying out the principles established by the late Secretary, and that the details of administration, and the general plans of operation, are consequently not unfamiliar to me. My association has indeed been, indirectly, longer than the time mentioned, since as early as 1848 I visited Professor Henry and was engaged by him to carry out certain researches in reference to the natural history of Pennsylvania, aided by a grant of money from the funds of the Institution, for the purpose.

Although the fact of the death of Professor Henry was promptly spread over the United States and transmitted throughout the Old World by means of the telegraph, it was thought proper, in accordance with the usage of similar establishments, to make a formal announcement by a circular letter, addressed to the foreign correspondents of the Institution. A circular was accordingly prepared in the name of the Chancellor and widely distributed. This has elicited a great number of responses, containing gratifying expressions of condolence and sympathy.

The regular session of the Board of Regents for the winter of 1877 was held in January, 1878, at which time the report for 1877 was presented by Professor Henry and approved. An extra meeting was called on the 17th of May, on the day after Professor Henry's funeral, at which an election of his successor took place, and arrangements were made for a proper eulogy and the memorial meeting in January, 1879.

The law of Congress establishing and organizing the Smithsonian Institution makes no provision for the discharge of the duties of the chief officer by any person other than the Secretary; and as no bills for services, for salaries, labor, supplies, &c., can be paid without his indorsement, the disability or death of the Secretary during the recess of the meetings of the Board is likely to involve very serious difficulties. For the purpose of providing for this contingency, Senator Hamlin, a Regent of the Institution, has introduced a joint resolution into the Senate, providing that in case of the death, disability, or absence of the Secretary, the Chancellor be empowered to appoint some one to discharge

his duties until any necessary provision can be made by the Board in full session, it not being expected that the Board could be brought together outside of the period of the meeting of Congress. This resolution has already passed the Senate, and it is hoped will soon pass the House and become a law.

The only change in the Board of Regents to be placed on record is the resignation of Mr. Bancroft and the election of General Sherman, a former Regent, to fill his place. General Sherman was also elected by the Board at its special meeting of the 17th of May to serve as one of the Executive Committee.

The continued expansion of the operations of the Institution, especially those connected with its department of international exchanges, has called for accommodations more extended than those that have been available; and Professor Henry, for some time before his death, had in contemplation a removal from that portion of the building occupied by his family, to a private residence in the city. He was considering this question more urgently when his illness supervened, and of course interrupted any further action on his part.

Although the occupation of the east wing of the building free of rent was one of the privileges of the Secretary of the Institution, I found that all the rooms in the building could be used to great advantage as offices of the Institution; and I therefore determined, with the consent of the members of the Executive Committee, to devote them to that purpose. A door was opened in the wall separating the present rooms from the apartments adjacent to them, and some other trifling inexpensive alterations were made, by which the entire house was transformed into a series of offices and work-rooms. Every room is now in use, and the entire force of clerks and employés has been concentrated in the east range and wing, so that they are closely connected in their work, adding very greatly to the efficiency of operations.

A system of electric bells and telephones has been established throughout the building, by means of which instant communication can be had between the several offices and work-rooms without involving the loss of time required to pass from one to another, or without calling any one from his work.

FINANCES.

In the report of the Executive Committee will be found a detailed statement of the finances of the Institution, which are believed to be in a satisfactory state. The amount to the credit of the late Secretary at the time of his death was $8,522.98. This was transferred on the 28th of May, 1878, to the credit of his successor, with whom a new account was opened at the Treasury. The premium on the gold-bearing interest of the Smithsonian endowment, which has heretofore constituted a more or less prominent item of the receipts for the year, has, of course, disappeared; only a small percentage having been realized on the July payment. As the natural counterpart to this, however, the reduction in

the price of labor and the decrease in the cost of many articles of general supply leaves the Institution in a correspondingly better financial condition than before.

The following is a statement of the condition of the Smithson fund at the beginning of the year 1879:

The amount originally received as the bequest of James Smithson, of England, deposited in the Treasury of the United States in accordance with the act of Congress of August 10, 1846	$515,169 00
The residuary legacy of Smithson, received in 1865, deposited in the Treasury of the United States in accordance with the act of Congress of February 8, 1867	26,210 63
Total bequest of Smithson	541,379 63
Amount deposited in the Treasury of the United States, as authorized by act of Congress of February 8, 1867, derived from savings of income and increase in value of investments	108,620 37
Amount received as the bequest of James Hamilton, of Carlisle, Pa., February 24, 1874	1,000 00
Total permanent Smithson fund in the Treasury of the United States, bearing interest at 6 per cent., payable semi-annually in gold	651,000 00
In addition to the above, there remains of the extra fund from savings, &c., in Virginia bonds and certificates, viz: Consolidated bonds, $58,700; deferred certificates, $29,375.07; fractional certificate, $50.13; total, $88,125.20, valued January, 1879, at	34,000 00
Cash balance in United States Treasury at the beginning of the year 1879, for current expenses	19,632 57
Total Smithson funds January 8, 1879	704,632 57

BUILDING.

Some damage was done to the Smithsonian building by the severe storms of the summer of 1878, and considerable expense incurred in repairs. The finial on the west tower was blown off and a large number of slates torn away, all of which required reconstruction. The occasion was taken to give the gutters, spouts, and lightning-rods a thorough overhauling, leaving everything, it is believed, in the best condition. The basement has been cleaned and whitewashed, and all unserviceable material, including scrap-iron, &c., has been suitably disposed of.

PUBLICATIONS.

As has been frequently stated in former reports, the publications of the Institution consist of three classes: The first, the "Smithsonian Contributions to Knowledge"; the second, the "Smithsonian Miscellaneous

Collections"; and the third, the "Annual Reports of the Regents" of the Institution. The works of the first class, the Smithsonian Contributions to Knowledge, are published in quarto form, and are intended to embrace original memoirs, either the result of special investigations authorized and directed by the Institution, or prosecuted under other auspices and presented to it. The works of the second class, the Miscellaneous Collections, are similar in plan and construction to the "Contributions," but are in octavo form, and embrace more particularly monographic and descriptive papers in natural history, formal or systematic lists of species of animals or plants, physical tables, reports on the present state of knowledge in some department of physical or biologic science, &c. As with the "Contributions," each volume is composed of several distinct and independent papers, having no necessary connection with each other, the collection being determined chiefly by the aggregate number of pages suitable for a volume of average size. The average number of pages in the quarto volume is about 600; in the octavo volume, about 800. Each paper or memoir in either class is separately paged and indexed, with its own title-page, so as to be complete in itself, and separately distributed according to its subject. Of the quarto "Contributions," twenty-one volumes, and of the "Collections," fifteen volumes have been published.

The Smithsonian annual reports commenced in 1847, and being made to Congress, are published by that authority, and not at the expense of the Smithson fund. The earlier reports of the Secretary were printed in small pamphlet editions, but were collected and reprinted with the report for 1853, and with this the series of bound volumes may be said to have begun. The number, or edition, ordered by Congress has varied from year to year, but the proportion of copies placed at the disposal of the Institution has been distributed to its correspondents as fully and liberally as possible.

Smithsonian Contributions to Knowledge published in 1878.—For several years past the Institution has had in its archives a paper by the late Prof. Henry J. Clark, relating to the Lucernariæ, an extremely interesting group of marine animals closely allied to the *Acalephs*, or Jelly-fish. The death of the author before the work could go to press, and the difficulty of finding any one willing to undertake the editing of it, prevented immediate action on the memoir; but Prof. A. E. Verrill having agreed to take charge of the work, it was at length put to press, and was finally published in 1878. The memoir consists of 138 quarto pages and eleven plates, and it has been distributed to the leading zoologists. The Institution is under great obligations to Professor Verrill for the careful and critical supervision of the typographical execution of the work, as well as for some important notes and rectifications. Mr. Samuel F. Clark, of Johns Hopkins University, is also entitled to the thanks of the Institution for assistance in revising proofs during the period when Professor Verrill was ill.

The second quarto memoir, published in 1878, is a paper by Mr. William H. Dall, "On the Remains of later Prehistoric Man, obtained from caves in the Catherina Archipelago, Alaska Territory, and especially from the caves of the Aleutian Islands." In the Secretary's report for 1875 (page 48) will be found a brief notice of some interesting mummified human remains from the Aleutian Islands presented by the Alaska Commercial Company. These comprised a series of nine mummies from Kagaymil Island and one from Prince William's Sound. Mr. Dall's memoir on the subject has been printed, containing the result of a careful examination of these remains and the relics found with them, an account of the tradition and history relating to them, and such explanations of the manufacture, character, and use of the various associated articles as the author's observations during eight years in that region enabled him to furnish. Ten heliotype illustrations accompany the memoir, which, though inferior to finely engraved views in an artistic point of view, offer a style better suited to convey a correct idea of the complicated details represented than any other mode of illustration at present in use.

Two remaining quarto papers now in press will be published early in the year 1879. The first of these is the memoir of Dr. S. Habel, describing "The Sculptures of Santa Lucia Cosumalwhuapa, in Guatemala." As this interesting work was quite fully described in the Secretary's last Report (for 1877, pages 13 to 16), it is unnecessary here to particularize it further.

The other paper referred to (constituting the fourth of the abovementioned series) is "A Classification and Synopsis of the Trochilidæ," by Mr. D. G. Elliot. The beautiful and brilliant-colored "metallic" plumage of the humming-birds in many instances assumes, among individuals of the same species, widely-contrasted hues, rendering the correct identification of the species by the naturalist only possible through a considerable experience or the opportunity of examining a large series of specimens. Within the past ten years a large number of new species have been discovered in this group, supplying important links between previously-known species that could not have been heretofore harmoniously ranged in the family. The vast collection which has produced the material for this work contains many types and specimens of great rarity, obtained from such well-known trochilidists as Bourcier, Gould, Verreaux, &c. Of the 426 species acknowledged in the work as worthy of such rank, 380 are contained in the author's collection, represented by about 1,800 specimens. A novel feature of the work is the engraving that accompanies the diagnosis of each genus, illustrating the characteristics by which any specimen may be readily referred to its proper genus. The characters recognized as most important for determining a system of classification are taken from the male bird alone, it being found impossible to harmonize in so large a group any that should be selected from the two sexes indiscriminately. The present synopsis

will be useful both to the student and to the naturalist by enabling them to easily identify their specimens, and will assist them to a natural classification of the family.

Miscellaneous Collections published in 1878.—Among the "Collections" published in the past year have been several very important circulars intended to facilitate the collection of material for scientific research. The first of these, prepared by Prof. O. T. Mason, at the request of the Institution, relates to the various remains of American archæology scattered throughout different parts of our continent, consisting of mounds, earthworks, ditches, graves, &c. A vast amount of isolated and disconnected research has been directed toward these objects, in most cases by persons ignorant of the true method of examination or of the precise nature of the problems to be solved in connection with them. The circular referred to comprises 15 pages, indicating the features of special interest, a record of which it is desired to possess, and giving a table of symbols to be used to secure uniformity of illustration and facility of reference. It also invites contributions of notes, surveys, maps, illustrations, &c., of the objects, and also requests the contribution of such specimens as may be found in the localities described, including stone implements, pottery, bone tools, &c. Of this circular many thousand copies have been distributed, and these have elicited a vast amount of material. This is all carefully and systematically classified and arranged, and as soon as it appears to be measurably complete it will be placed in the hands of one or more specialists, by the aid of whom it is hoped the Institution may be able to prepare an exhaustive treatise on the subject which will mark as important a stage of progress in the history of American archæology as was done by its publication, in 1849, of Squier & Davis's work upon the ancient mounds of the Mississippi Valley.

The second circular published was one prepared by P. R. Uhler, of Baltimore, in reference to the collection of specimens of *craw-fishes*. This group of fresh-water crustaceans, which is found in most parts of the world, with some curious exceptions, furnishes an interesting field for inquiry into the modifications produced in animal forms by certain physical or other conditions, Professor Huxley, among others, having lately prepared an elaborate paper upon the subject. In previous years quite a number of new craw-fishes were described from the collections of the National Museum, by Mr. Charles Girard. The group was afterwards made the subject of a very comprehensive investigation by Dr. H. Hagen, of Cambridge. It is, however, thought that there is room for still further inquiry, and the material in possession of the Smithsonian Institution will be placed in the hands of competent specialists for investigation. In the circular an illustration of the craw-fish is given, for which the Institution is indebted to Messrs. Appleton & Co., New York.

The third circular, to form part of a forthcoming volume of Smithsonian Miscellaneous Collections, is in reference to the living *reptiles* of

North America. The United States Fish Commission, under the auspices of the Smithsonian Institution, exhibited at the Philadelphia Centennial of 1876 an extremely interesting series of plaster and papier maché casts of fishes, cetaceans, and some reptiles, all carefully colored from nature, and representing a much larger number of such objects than had ever been brought together under one roof. Since that time the artists connected with the National Museum have been diligently engaged in extending and improving the series, and for nearly two years past their efforts have been conducted especially in the line of the reptiles. The circular in question was intended to indicate precisely the forms or species desired, and it has been extensively distributed. As the result, the Institution was the recipient, in 1878, of very large numbers of living turtles, serpents, lizards, salamanders, &c., the greater portion of which has been carefully molded and reproduced in artistic style. It is believed that no museum extant can show such a series of serpents, in their natural attitudes, as is now on exhibition in the National Museum.

Another publication of 1878 is a new "List of Foreign Correspondents." The rapid increase in the number of scientific establishments in relationship with the Institution requires a new edition of this list every few years; and although the present one is much more extensive than that published in 1872 (containing 2333 numbers of titles as compared with 1919), even now arrangements are being made by the Institution for a still more complete and exhaustive edition. With this view a circular has been sent to all the names upon the present list, asking for rectifications or typographic corrections, and the addition of any addresses of public libraries, learned societies, or scientific bureaus of governments not already included. The Institution also requested secretaries of societies to furnish a list of the names and addresses of persons actively engaged in scientific or literary investigations in their respective towns, together with the particular branches of learning to which each was devoted, with the view of facilitating communication and exchanges with *specialists* in all parts of the world. The responses to these requests are coming in rapidly; and when all are received, a suitable arrangement and publication of the material will be made.

Twenty years ago (in 1858), the Institution published a list of the *Diptera* (flies, musquitoes, &c.) of North America, by Baron R. Osten-Sacken, at that time attached to the Russian Legation at Washington. The author, although especially a student of the order of diptera, was interested in other groups, and coming to the United States at a time when our entomologists were few and widely scattered, he devoted a considerable part of his leisure to travel over the country, making the personal acquaintance of most of those interested in this branch of natural history. In that connection he rendered a valuable aid to the extension of American entomologic science, which is entitled to public recognition. Through his efforts numerous entomologists, situated far

apart, and prosecuting studies of a similar character, without the knowledge of other labors than their own, were brought into relations of correspondence and exchange, and thus, by their mutual sympathy and support, and by the concentration of effort on the part of each to some special line of research, the common interest of science was advanced. We regret to say that after many years sojourn in this country, Baron Osten-Sacken has returned to Europe, where, however, his assistance is continually invoked by entomologists desiring information in regard to type specimens, books not procurable in the United States, &c.

The list of *Diptera* aforesaid (published in the Miscellaneous Collections) brought together a mass of references to the descriptions of about 1,800 species, scattered in more than one hundred different works and scientific papers. Such a publication was an indispensable preliminary step before any study of the diptera could be attempted. This formed the first of a series of works undertaken by the Institution to facilitate the study of entomology, which has included diptera, coleoptera, lepidoptera, neuroptera, and hymenoptera.

During the past year the work of Baron Osten-Sacken, much extended by his later critical studies, has been republished by the Institution. This new edition of the work is not merely a revision of the catalogue published twenty years ago; but it is an entirely new one prepared on a different plan. The difference between *eleven* and *sixty-six*, the number of species of one genus, *Trypeta*, represents the addition made to our knowledge during the interval between the two catalogues. Other genera give similar results. Another important difference between the old and new catalogues consists in the fact that the majority of the species enumerated in the latter are represented in a collection now in the Museum of Comparative Zoology in Cambridge, Mass., which contains over 2,000 named and described species of diptera from North America. The region embraced in the present catalogue is the whole of North America, including the West Indies. It has been the effort of the author to make sure that every name in the list should actually represent a different species. To attain this result, he visited and examined the museums in London, Paris, Lille, Berlin, Frankfort, Darmstadt, Turin, and Vienna. Of all orders of insects the diptera offer probably the most difficulties to the describer, arising from the minuteness of the characters on which generic and specific distinction are based. Each family requires a special study, and a dipterologist may be very well versed in some families, without being able to express any opinion with regard to questions concerning others. In the introduction to the catalogue, the author presents some recommendations as to the best course to be pursued in the study of diptera, and advises *specialization*. Amateurs may collect and name specimens, but should not publish anything until they have chosen some single family and nearly exhausted it by study and collecting. "The exhaustive study of a single family is far more remunerative both in pleasure and in usefulness

than the random description of numerous new species." The catalogue forms an octavo volume of 324 pages, and includes a full index.

Another paper published in 1878, to be mentioned, is a "Botanical Index," prepared by Prof. Sereno Watson, of Cambridge, Mass. The purpose of this index is to furnish references to whatever has been published respecting the plants of North America, under their Linnean specific names, in works or papers that may be classed as belonging to systematic botany. For the region west of the Mississippi and for British America, the literature of which is almost wholly fragmentary and greatly scattered, and on account of which especially the work was originally begun, it is intended to be complete. And it is essentially so also for the eastern flora, where, however, there is not the same necessity that the citations should be exhaustive. To avoid the perpetuation of errors it was desirable to eliminate false species and to correct wrong determinations wherever they had gone upon record. This could not have been thoroughly done without a complete revision of the flora itself, which was of course out of the question; nevertheless it was rendered to a considerable extent possible as respects the western flora, by the author's connection with the "Botany of California"; and in many other cases he was enabled to decide upon the validity of species, and to verify determinations or to settle doubtful synonymy by comparisons of specimens themselves in the collection of the Harvard Herbarium.

The delays that have arisen in the preparation of the volume have not been without compensation in the far more complete and satisfactory results which were only thus made possible; and the deficiencies of the earlier portions are largely supplied by the copious appendix, which makes the whole essentially complete, up to the date of publication. The portion now printed covers the ground of Torrey and Gray's Flora of North America, which was published in 1838–1840, and is now so completely out of date as to leave this portion of our botany nearly as much in need of revision as any other. Until such revision can be made (and it must still be delayed some years), the "Index" will necessarily be a partial substitute—in some respects sufficient, inasmuch as it shows what genera and species are recognized as forming our flora, and also as concerns the synonymy, which could not be given with any such completeness, within the limits of the desired revision, and moreover sufficient in its references to all existing descriptions of those species. In any given case, these descriptions may indeed be practically inaccessible, or they may be incomplete or faulty, and it is herein that nothing can be a substitute for a "Flora," which shall bring together into one volume perfected descriptions, together with such grouping of genera and species as to indicate their natural affinities. For the preparation of such a Flora, or for the study of any special portion ot the field, the present Index will meantime be an important aid, giving as it were a skeletonized history of each individual species, and affording a clue to all that is known toward the needed filling out of the outline. The

total number of orders given in the Index is 69; of genera, 545; of species, 3,038. The work forms an octavo volume of 484 pages.

A work too long delayed, and constituting a most important addition to the Miscellaneous Collections—a memoir of the founder, James Smithson, with a collection of his published contributions to science, followed by a documentary history of the organization, rise, and progress of the Institution—has during the past year been collected and prepared, and is now in press.

At a meeting of the Board of Regents, held January 23, 1878, it was resolved that the Secretary be requested to have a memoir of James Smithson prepared and published, to include all his scientific papers now accessible; and that the Secretary prepare and publish a history of the origin and progress of the Institution. In accordance with these resolutions, the Secretary directed Mr. William J. Rhees, the chief clerk, who had been connected with the Institution for more than twenty-five years, to commence the collection of material for these works, and on the death of Professor Henry, Mr. Rhees was requested to continue his labors. No compilation of this character having been previously attempted, the investigation involved a laborious research.

The scientific papers of Smithson, which originally appeared in the Philosophical Transactions of the Royal Society of London, and in Thomson's Annals of Philosophy, have been collected and reprinted; they occupy 120 octavo pages. These memoirs were submitted to several chemists and mineralogists for an estimate of the scientific value of Smithson's researches, and the present acceptance or recognition of the results obtained by him.

The history of the Institution contains the will of Smithson, the manner in which the bequest was obtained by the United States, the correspondence between Hon. Richard Rush, the special agent of this government, and the officials and attorneys in England, an account of the suit in chancery which was found necessary to obtain the fund, an account of the residuary legacy or sum left in England as the principal of an annuity to the mother of the nephew of Smithson, and how this was finally obtained and added to the fund. The legislation of Congress in reference to the bequest is given, including a reprint of every resolution, memorial, report, speech, and act from the proceedings of Congress that have any reference to the fund or to the establishment and objects of the Smithsonian Institution, from December 17, 1835, when President Jackson first informed Congress of the bequest, down to the 1st January, 1878.

The collection of this part of the history involved a minute examination of every page of the "Globe," containing the report of the proceedings of Congress, and also a large number of documents and many of the records printed and in manuscript on file at the Capitol or elsewhere. The various plans proposed in the Senate and House of Representatives for the carrying out the intentions of Smithson, by John Quincy Adams,

Mr. Robbins, Mr. Choate, Mr. Marsh, Mr. Owen, and many others are given in full, and form an exceedingly interesting exhibit of the views of men in political life as to the best means of increasing and diffusing knowledge. This part also includes the history of the controversy in relation to the management of the Institution arising from the resignation of Mr. Choate from the Board of Regents, and the speeches of Senators Pearce, Mason, Douglas, Badger, and Clayton, and of Representatives English and Meacham, together with the reports of the Senate Judiciary Committee, and of a special committee of the House. As throwing light on much of Congressional action and to show the intense interest Mr. John Quincy Adams felt in the bequest, copious extracts are made from his diaries.

The volume also contains the various plans proposed for the organization of the Institution by scientific and literary men, including Mr. Rush, Dr. Wayland, Dr. Cooper, Dr. Chapin, with the report of the committee of organization of the Board of Regents; the programme presented by Professor Henry in December, 1847, and the opinions of this programme expressed by Dr. Beck, Professor Silliman, Dr. Gray, the American Academy of Arts and Sciences, the presidents of Columbia, Williams, Hamilton, Delaware, Pennsylvania, Georgetown, Amherst, Saint John's, Brown, Bowdoin, Charleston, Hampden Sidney, Madison, William and Mary, Cumberland, Alabama, Marietta, Tennessee, North Carolina, Trinity, and many other colleges and societies.

These articles will form parts of the Smithsonian Miscellaneous Collections, and will not only be of interest to the Regents and those immediately connected with the management of the Institution, but to all who wish to ascertain the views and acts of some of our most prominent men in relation to science for nearly half a century. The history of the Institution will show what difficulties surrounded its organization, the diversity of opinion as to its proper functions, the opposition to be overcome, and the value of the wide and comprehensive plans of the Secretary, Professor Henry, to whose clearness of conception, firmness of purpose, and purity of character the success of the Institution is mainly indebted. His views, though but little understood and appreciated at first, have steadily gained the favor of the scientific and literary world, and are now universally recognized as the best adapted to accomplish the great purpose of Smithson.

Bulletins of the National Museum.—In the Secretary's Report for 1875 (page 14) it was stated that, during the past year another series of publications, which would form a part of the Miscellaneous Collections, had been commenced under the above title. This series is intended to illustrate the collections of natural history and ethnology belonging to the United States, and constituting the stock of the National Museum, of which the Smithsonian Institution is the custodian. These bulletins, prepared at the request and mainly by the attachés of the institution, have been

printed under the authority of the Secretary of the Interior. They form an independent series, which has proved very acceptable to naturalists, as enabling them to obtain prompt information as to the additions to and the components of the National Museum.

The following is a list of the Bulletins already published:

No. 1. Check-list of North American Batrachia and Reptilia; by Edward D. Cope. 1875. 106 pp.

No. 2. Contributions to the Natural History of Kerguelen Island; by J. H. Kidder, M. D.; Part I, Ornithology; edited by Elliott Coues. 1875. 61 pp.

No. 3. Contributions to the Natural History of Kerguelen Island; Part II, Oölogy, Botany, Geology, Mammals, Fish, Mollusks, Insects, Crustaceans, Annelids, Echinoderms, Anthozoa; by Kidder, Coues, Gray, Endlich, Gill, Dall, Osten-Sacken, Hagen, S. J. Smith, Verrill, and S. F. Clark. 1876. 122 pp.

No. 4. Birds of Southwestern Mexico; collected by Francis E. Sumichrast. By George N. Lawrence. 1876. 56 pp.

No. 5. Catalogue of the Fishes of the Bermudas; by G. Brown Goode 1876. 82 pp.

No. 6. Classification of the collection to illustrate the Animal Resources of the United States; by G. Brown Goode. 1876. 139 pp.

No. 7. Contributions to the Natural History of the Hawaiian and Fanning Islands, and Lower California; by Thomas H. Streets, M. D. 1877. 172 pp.

No. 8. Index to the names which have been applied to the subdivisions of the class Brachiopoda previous to the year 1877; by William H. Dall. 1877. 88 pp.

No. 9. Contributions to North American Ichthyology; Part I; Review of Rafinesque's Memoirs on North American Fishes; by David S. Jordan. 1877. 53 pp.

No. 10. Contributions to North American Ichthyology; Part II; Cottidæ, Etheostomatidæ, Percidæ, Centrarchidæ, Aphododeridæ, Dorysomatidæ, Cyprinidæ, Siluridæ. By D. S. Jordan. 1878. 120 pp., with 45 plates.

No. 11. Not yet published.

No. 12. Contributions to North American Ichthyology; Part III; by D. S. Jordan and A. W. Brayton. 1878. 237 pp.

Of the above, those published during the past year are the Bulletins numbered 10 and 12. The former comprises the second part of Prof. David S. Jordan's Contributions to North American Ichthyology, and includes notes on Cottidæ, Etheostomatidæ, Percidæ, Centrarchidæ, Aphododeridæ, Dorysomatidæ, and Cyprinidæ, with revisions of the genera and descriptions of new or little known species; and Synopsis of the Siluridæ of the fresh waters of North America, with a bibliography of all the genera and species. It forms an octavo pamphlet of 120 pages, with 45 plates.

The latter (No. 12) comprises the third part of Contributions to North American Ichthyology, including the distribution of the fishes of the Allegheny region of South Carolina, Georgia, and Tennessee, with descriptions of new or little known species; by David S. Jordan and Alembert W. Brayton. This paper is based primarily on the collections made by the authors and a party of students of Butler University, Ohio, during the summer of 1877, in various streams in the Southern States, classified under the following basins: 1, Santee; 2, Savannah; 3, Altamaha; 4, Chattahoochie; 5, Alabama; 6, Tennessee; 7, Cumberland. In the course of the investigations detailed in this paper some light has been thrown on the laws which govern the distribution of freshwater fishes in general. A synopsis is also given of the family Catostomidæ; by David S. Jordan, and a bibliography is given of all the known works on Catostomidæ.

Proceedings of the National Museum.—In imitation of the practice of those learned societies which publish periodically descriptions of new species, &c., in the form of proceedings of weekly or monthly meetings, and thus present to the world the discoveries connected with the establishment at the earliest practicable moment, it appeared to be very desirable that the National Museum should have some medium of prompt publication for announcing descriptions of specimens received (many of which are new species), as well as other interesting facts relative to natural history furnished by the correspondents of the Institution. To meet this want, an order was obtained from the honorable Secretary of the Interior, authorizing the publication of a volume of "Proceedings of the National Museum" for the year 1878, not to exceed 500 pages.

The publication of the "Proceedings of the National Museum" has accordingly been commenced, the work comprising short descriptions of the additions to the Museum, and accounts of new species, or illustrations of species collected in particular regions of country. It is printed in successive signatures, as fast as copy sufficient for 16 pages is prepared, each signature having printed at the bottom of its first page the date of actual issue, for settling any questions as to priority of publication. It is at once distributed to scientific societies and leading naturalists in this country and in Europe. A large number of important articles of greater or less length have already been printed, to form the volume for 1878, now nearly completed. They consist of articles on new species of fishes collected by the United States Fish Commission; papers on the birds of the West Indies, collected under the auspices of the Smithsonian Institution, &c. Of this series, about 250 pages have been printed during the year 1878, being produced (as in the case of "Bulletins") at the expense of the Interior Department, by which all the disbursements connected with the service of the National Museum are made.

Reports of the United States Fish Commission.—A series of publications which may be considered as in some respects connected with the work of the Institution not only in the *personnel*, but in the subjects of natu-

ral history discussed and in the resulting contributions to our knowledge may properly be here noticed. The present Secretary being at the head of the United States Commission of Fish and Fisheries, and the work accomplished by this agency in increasing and diffusing scientific as well as practical information being quite within the objects and province of the Institution, much of the material would legitimately form a portion of the Smithsonian Contributions or Miscellaneous Collections. These reports are, however, published by the government, and are distributed by Congress.

Four volumes of this series have been published, each being of octavo size and comprising about 1,000 pages. The last of these reports, published in 1878, contains 1,089 pages, and embraces: (A) General considerations on the progress of operations; (B) Inquiry into the decrease of the food-fishes; (C) The propagation of food-fishes, as the shad, the salmon, the white-fish, and the carp; (D) Tables showing the distribution of shad, salmon, &c., the places, dates, and quantities hatched by the United States Fish Commission from 1872 to 1876. The Appendix contains a number of important papers, the most elaborate of which is a history of the American whale fishery, by Capt. Alexander Starbuck. This is followed by one on the carp and its culture, by Rudolph Hessel.

Smithsonian annual report.—The Annual Report of the Institution for 1877 was transmitted to Congress on the 6th of February, 1878, and 10,500 extra copies of it were ordered to be printed, 1,000 for the use of the Senate, 3,000 for the House of Representatives, and 6,500 for the Institution. It forms an octavo volume of 500 pages, with 49 wood-cut illustrations. The principal articles in the Appendix are a list of the more important explorations and expeditions, the collections of which have constituted the main sources of supply for the National Museum from 1850 (and even earlier) to 1877; a translation of Holmgren's memoir on color-blindness, in connection with which is reprinted an article on the same subject by Professor Henry, published in 1845; translations of the reports of the transactions of the Geneva Society of Physics and Natural History for 1875, 1876, and 1877, of Weisman's article on the change of the Mexican Axolotl to an Amblystoma, and of short memoirs on meteorological subjects, by Hann, Reye, Sohncke, Colding, and Peslin; notes on the history and climate of New Mexico, by Thomas McParlin, and brief articles on ethnological topics, by C. Rau, George L. Cannon, Moses Strong, J. N. de Hart, E. E. Breed, M. W. Moulton, Mrs. Gilbert Knapp, W. H. R. Lykins, James Shaw, J. Cochrane, George W. Hill, H. B. Case, F. Miller, Joseph Friel, W. M. Clark, Charles C. Jones, jr., W. B. F. Bailey, A. S. Gaines, K. M. Cunningham, S. S. Haldeman, A. M. Harrison, S. P. Mayberry, William M. Taylor, Edwin M. Shepard, George J. Gibbs, F. L. Galt, and Stephen Bowers.

ANTHROPOLOGY.

As in previous years, the subject of the anthropology of North America received special attention from the Institution. Its earliest publica-

tion, constituting the first volume of the "Smithsonian Contributions to Knowledge," was the work of Squier and Davis on the ancient monuments of the Mississippi Valley; and to this the inquiries of the past third of a century into the early history of man in the Northwest owe their chief impetus. The book is a universal guide, and is even now a standard. The edition at the command of the Institution has long since been exhausted, and it has been proposed to republish it to meet the urgent calls of the public. Unfortunately, the destruction of the wood-cuts by the fire of 1865 would render the cost of reproducing them so great as to make it doubtful whether it would not be better to use the money that would be needed for it in the preparation of a more extended work on the same subject, which has been in contemplation by the Institution for several years past.

In the list of publications of the year is mentioned an archæological circular, prepared by Professor Mason, and distributed in very large numbers. The object of this has been to secure information of the minutest details in reference to the construction of mounds, earthworks, and other traces of aboriginal engineering, as well as of articles of every description and character found in the mounds, in the graves, and in the superficial soil.

The answers to this circular have been unexpectedly abundant and varied, and a great mass of material is now in the possession of the Institution and in process of elaboration. The papers in relation to the mounds, earth-works, &c., are placed in the hands of Professor Mason, of Columbian University, for critical investigation and examination; and under his editorship they will be arranged and ultimately printed, together with numerous illustrations which accompany them. A series of maps will also be completed, containing information obtained from these and other sources, so that we shall have some satisfactory idea of their geographical distribution, extent, &c., throughout the country.

The investigation of the aboriginal relics is in charge of Prof. Charles Rau, the superintendent of the archæological department of the National Museum. As preliminary to a systematic work in this direction Prof. Rau has lately completed the rearrangement of the archæological collections of the Museum, carefully eliminating the duplicates, but retaining whatever may serve to illustrate the geographical distribution of forms and material, or the variation in pattern. Under his direction, also, numerous drawings have been made on wood and partially engraved.

A detailed statement of the donations to the National Museum relating to this branch of science will be found in the list of Contributors to the Museum, and also in the general account given subsequently, of the several additions to the Museum. It may, however, be well to call special attention to two northern collections in this department; one received from Mr. E. W. Nelson, a signal-station observer at Saint Michaels, in Alaska; the other from Mr. L. Kumlien, the naturalist of the Howgate expedition to Arctic America. These illustrate very fully

the nature and character of art among the Esquimaux on both sides of the continent, and with what has been heretofore obtained from the same region, as also the coast of Arctic America, through the agency of Mr. R. R. McFarlane, render this series the most complete of its kind in existence.

Special acknowledgment is due to the American Express Company, through Jas. C. Fargo, esq., general superintendent, for giving instructions to all the agents of the company to co-operate with the Institution in the collection of archæological material for the Museum.

METEOROLOGY.

Among the first objects of consideration by Professor Henry, after the commencement of active operations on the part of the Smithsonian Institution, was that of meteorology, and for more than twenty-five years it has received a large proportion of his own attention and consideration, as well as the aid of the Institution as far as its means would permit. Prior to the period named more or less attention had been paid to the subject, and efforts had been made to secure an extensive and continuous series of observations. These, for the most part, however, were limited to single places, and more rarely extended to counties or States; and it is to Professor Henry that we owe the establishment of a uniform system over an entire continent. Little by little the work was extended until, at the time of its fullest activity, it had its agents in nearly every county of most of the States of the Union; indeed, throughout the whole of British North America, and even in the remotest post of the Hudson's Bay Company, in Mexico and Central America, the services of observers were utilized. Some of these were provided with full sets of meteorological apparatus, so that observations could be made with the utmost precision; others had only a thermometer and barometer, while still others had nothing but a thermometer.

Several different series of blanks were distributed by the Institution corresponding to the different classes. The blanks were returned monthly and duly filed. In the earlier part of the work some instruments were furnished, such as barometers and thermometers. Subsequently, however, it was found that the expense was too great, and only occasionally were thermometers and rain-gauges supplied. There was, however, no lack of persons who were ready to take part in this system, and not only to give their time, but also to purchase their own instruments.

The interest of the observers was maintained by a constant correspondence with the Institution. Copies of the Smithsonian Reports and other publications were duly transmitted to them, and any inquiries or communications from them on scientific subjects were promptly responded to.

In this way a body of collaborators was secured to the Institution, whose services cannot be overestimated, since they not only furnished

information relating to meteorology, but they were always ready to supply information and assistance in other directions. To that body of men the National Museum owes a very large part of the extensive and complete series of illustrations of North American natural history that gives to it so great a prominence, this being the result of successive applications for aid from particular classes. Thus, whenever the attention of the Institution was directed to the fact that some particular branch of natural history required its fostering care, circulars were prepared and issued to the meteorological correspondents, invoking co-operation, and asking them to collect objects of the kind that might be found in their neighborhood, so that, not only all North American species might be gathered, but accurate determinations made of their geographical distribution. Very extensive responses usually followed these appeals, and in many cases sufficient material was secured to place the subject on a permanent and satisfactory basis. The works of the Institution on many orders of insects and on fresh-water and land shells, reptiles, birds, mammals, &c., were all based more or less entirely on collections and information obtained by the Smithsonian observers.

As a result, therefore, of over twenty-five years' observations by such men, the mass of meteorological information obtained became very great, and even though a certain per cent. of the observations could not lay claim to that minute accuracy which is generally required, yet it was found that, for many purposes, such as the general indications of variations in temperature, barometrical pressure, rain-fall, &c., in the collation of all observations the errors disappeared, and an average was secured which did not differ essentially from what would have been derived from more accurate observations.

The results of these observations have been published by the Institution in several forms. During the time when the work was carried on partly by the assistance of the Department of Agriculture, the reports of that establishment contained the general results. In 1855, two quarto volumes were published at the expense of the government. Subsequently, however, a system of special digests was undertaken under the supervision of Professor Coffin, for the winds; and of the temperature, rain-fall, &c., under Mr. Charles A. Schott, of the United States Coast Survey, a full account of which will be found in the former reports of the Institution.

A second edition of the work on the Winds of the Globe, commenced by Professor Coffin, and unfinished at his death, a few years ago, was completed under the auspices of his son, and published by the Institution. This is one of the most important treatises on meteorological science that has ever appeared from any press.

Shortly after being honored with the appointment as Secretary, I invited a committee, consisting of Mr. Charles A. Schott, Prof. Cleveland Abbé, and Mr. William Ferrel, to consider the subject of the unfinished meteorological work of the Institution, and to suggest a plan by which

it could be carried on and completed, with due reference to the state of its finances. This committee met at the Institution and carefully considered the whole subject, with the manuscripts before them, and concluded that a new edition of the rain-fall tables should be completed as soon as possible, this being a subject of great interest, both theoretically and in its practical applications. An allowance was therefore made for the completion of this work, and it will be ready for the press during the present year. The publication of this new edition of the rain-fall tables will be commenced and completed as soon as practicable. The barometrical reductions, the digest of the periodical phenomena of animal and vegetable life, &c., will be prosecuted as rapidly as the funds of the Institution will warrant.

It is, of course, unnecessary to refer to the fact that active operations in regard to meteorological observations, in accordance with the policy of Professor Henry have been transferred to the Weather Bureau of the Signal Department of the United States Army, under the care of General A. J. Myer, and that hereafter the meteorological expenditures will be confined to completing the presentation of the results obtained during the twenty-five years of the active work of the Institution in that direction.

RESEARCHES.

The appropriation made to Dr. H. C. Wood, jr. in 1876 and 1877 for experiments to determine the nature and cause of the increased temperature of the body during fever has been expended and a report of the investigations is being prepared for publication by the Institution. A brief abstract of this memoir will be found in the appendix to this report.

The first point to be determined was whether fever was as complex as it appears, or whether there be not some dominant symptom characteristic of the process. By artificially heating living animals, generally and locally, it was found that elevation of the bodily temperature is sufficient to produce all the nervous and circulatory symptoms of fever and that the cooling of the heated part is capable of removing the symptoms, so that fever may be defined to be a morbid process which produces elevation of the bodily temperature.

The next point was to determine whether the increase of the bodily temperature in fever was due to an increase of the amount of heat produced, or to the failure of the body to throw off its heat. For this purpose the laws governing the production and loss of animal heat in health were studied by means of calorimetric and cardiometric observations on animals under various conditions, and it was determined that there is in the cortical region a nerve-center which controls the production of animal heat.

The subject of fever itself was then investigated. The experiments were mostly made upon dogs, each experiment continuing for from three to six days. Thermometrical readings were made every twenty minutes

by night and by day, and the normal and febrile states were studied both when food was administered and when withheld. The result of this was to show that there are two sources of animal heat, one from the stored-up materials of the body, and the other from the food, the first being the one manifested in fever.

The results of the whole investigation are summed up in eleven conclusions which are given in the abstract referred to.

The publication of recent investigations of the motion of the moon* has rendered a re-discussion of the ancient solar eclipses desirable. This work has been commenced under the auspices of this Institution by Mr. D. P. Todd, M. A., Assistant Nautical Almanac Office. Hansen's tables of both the sun and moon are employed, the latter being corrected from the results of Professor Newcomb's researches. So far as the work has now progressed, the computations relate to seven eclipses—those of Thales, at Larissa, of Ennius, of Agathocles, at Stiklastad, and the two eclipses of the thirteenth century which have been discussed by Celoria, of Milan. The adopted value of the secular acceleration having been deduced from entirely independent data, it is hoped that this investigation will throw new light on the interpretation of the ancient eclipses, and point toward the true value of the secular acceleration which ought to be adopted in the construction of new tables of the moon. The progress of this investigation will be much facilitated by the new tables of eclipses,† now in press; and it is proposed to extend the original scope of the research to include a large number of supposed ancient ecliptic dates.

LABORATORY.

The original act of Congress calls for a laboratory as one of the elementary features of the Institution, and an establishment of this kind has always been maintained, with a greater or less degree of efficiency.

In consequence of the limited appropriations by Congress for the maintenance of the National Museum, it has for several years been impossible to secure the services of a mineralogist. Arrangements have been made, however, for such an officer; the laboratory has been put in thorough order; additional fittings have been introduced, necessary for its efficiency, and a complete stock of chemicals and other materials procured. It is now in proper condition for the prosecution of investigations requiring chemical and mechanical appliances.

The principal work of the laboratory at present is examining minerals sent to the Institution for that purpose from various parts of the country, very few days passing without the reception of one or more parcels, many of them from members of Congress, requiring consideration. The Institution does not undertake to make quantitative analyses, ex-

* Researches on the Motion of the Moon. By Simon Newcomb, Professor U. S. Navy. Washington Observations for 1875, Appendix II.

† Tables of Eclipses, from B. C. 700 to A. D. 2300. By Simon Newcomb, Superintendent Nautical Almanac. Washington, 1879.

cepting in behalf of the government, but is always ready to indicate the general composition of specimens sent for the purpose.

The laboratory will also be used in the identification of large quantities of crude mineral substances in charge of the Institution, to be classified preliminary to the selection of duplicates and their distribution to colleges and academies of the United States.

TELEGRAPHIC ANNOUNCEMENT OF ASTRONOMICAL DISCOVERIES.

As in previous years, the Institution has served as the medium for telegraphic communication between astronomers of the Old and New World, in regard to such astronomical discoveries as require prompt announcement, for the purpose of having all their phenomena investigated by concurrent action on both sides of the ocean. An accompanying list represents the announcements referred to and the dates at which they were respectively made. This feature of the work of the Institution is one of great importance, and is a very satisfactory demonstration of the extent to which its labors are prosecuted for the world in general, and not merely for a restricted portion of the United States.

The following is a list of the minor planets discovered in 1878:

No.	Name.	Date.	Discoverer.	Discoverer's No.	Observatory.
180	Garumna	January 29	Perrotin	5th.	Toulouse.
181	Eucharis	February 2	Cottenot	1st.	Paris.
182	Elsbeth	February 7	Palisa	12th.	Pola.
183	Istria	February 8	do	13th.	Do.
184	Deiopeia	February 28	do	14th.	Do.
185	Eunike	March 1	Peters	28th.	Clinton.
186	Celuta	April 6	Pr. Henry	?	Paris.
187	Lamberta	April 11	Coggia	2d.	Marseilles.
188	Menippe	June 18	Peters	29th.	Clinton.
189	Phthia	September 9	do	30th.	Do.
190	Ismene	September 22	do	31st.	Do.
191	Kolga	September 30	do	32d.	Do.

The comets of 1878 have been—

Comet I, discovered July 7, by Lewis Swift, of Rochester, N. Y. This comet was observed in America by Dr. C. H. F. Peters only, the majority of American observers being in the West on eclipse expeditions. It is probably identical with a comet discovered by P. Ferrari at Rome in July. On July 20, Tempel's periodic comet was found by Winnecke, quite away from its ephemeris place.

Encke's comet was found on August 3 by Mr. Tebbutt, of Windsor, N. S. W.

CORRESPONDENCE.

Mention has been made by my lamented predecessor on several occasions of the general character of the correspondence of the Institution,

and of its increasing extent. As might naturally be expected, this is now greater than ever before.

During the past year the number of letters received and sent out exceeded that for any previous corresponding period in the history of the establishment, the latter covering about 8,000 pages of press copy books. This increase was largely due—

(1) To renewed activity in the department of exchanges;

(2) To the execution of a comprehensive plan for extending the archæological cabinet of the Institution; and

(3) To the acknowledgment of letters of condolence on the death of the late Secretary.

As explanatory of the first of these sources of increase in the correspondence it may be stated that some months since a systematic effort was made looking to the early completion of as many as possible of the series of publications of foreign societies in the Smithsonian library, and, reciprocally, to supplying deficiencies in the numerous series of Smithsonian publications held abroad. To this end a communication was addressed to each of the nearly 3,000 foreign establishments in correspondence with this Institution, mentioning the volumes or parts of their respective transactions not at the time in possession of the Institution, and requesting that these be supplied; one of the conditions of a favorable response being a promise that the Smithsonian Institution would, in turn, fill whatever gaps it could in its own series. The responses, as was expected, were very prompt and most gratifying. Resulting therefrom, the Smithsonian library—now constituting the science library of the government—has been enriched by the addition of hundreds of valuable works of a character not usually obtained even by purchase, while the Institution itself has been brought into closer and more active relations than ever with its foreign correspondents of both hemispheres.

Regarding the second source of increase in the correspondence, it may be remarked that more recently a wide-spread distribution has been made of a circular relative to archæology. Indeed, it is hardly too much to say that this circular has been scattered broadcast over the land. Not only was it distributed to organized establishments of a literary, educational, and scientific character, to newspapers, postmasters, and, by generous permission of express companies, through their agents to individuals who might be known to them as specially interested in the subject, but a copy was systematically mailed with each *written* communication sent out by the Institution, no matter what the subject. This circular has proved more prolific of correspondence than was anticipated by its most sanguine friends. Inquiry soon followed inquiry for more detailed information as to desiderata in the way of specimens and information; requests were continuous to know if this or that article would be welcome; offers to lend objects for copying were numerous from individuals possessing unique and choice specimens, val-

uable to them only as heirlooms or curiosities, but who, while easily convinced of the little value of isolated collections in comparison with the importance to science of one grand, complete series, could not be persuaded to part with their archæological treasures; now and then private cabinets of more than ordinary character and extent have been brought to light; and, finally, modern "manufactories" of relics have been detected, and in this way forgeries, to some extent, driven from the market. Thus an extra amount of correspondence has been entailed that has proved no inconsiderable addition to the previous arduous labors of the officers of the Institution.

As the result, the Institution has received hundreds of specimens from all parts of North America as gifts, while by making copies in plaster or metal it has added to its cabinet many forms that would otherwise be unknown and inaccessible to the student as well as to the public at large. Many of these objects have proved of great archæological interest, and while not a few of them are almost indispensable for comparative study, all are more or less valuable in the elucidation of questions relating to the geographical distribution of aboriginal remains in the United States, and for filling gaps in State series. Moreover, by soliciting illustrations and descriptions of the rarer or more curious forms in private cabinets, the Institution has been saved much expense for transportation, its archæological experts rarely finding recourse to the original specimen necessary in determining what is or is not a desideratum.

As in previous years, the Institution was the recipient in 1878 of a large number of communications, having as a principal object the overturning of theories established by Newton and others, which, founded on experiment and observation, have long since been accepted as true by the scientific world. These, as is usual with papers of this class, while purporting to furnish the only rational explanation of the phenomena to be accounted for, generally displayed a degree of assumption entirely out of keeping with the spirit of true science; and while it would not be a work of much moment to prove to the unprejudiced, who may be acquainted with the subjects of such essays, that the propositions enunciated are wholly at variance with the fundamental and generally accepted principles of science, it is always exceedingly difficult to convince the authors of these "new doctrines" that they are not in accord with the scientific world. It would sometimes appear either that they are incapable of receiving the truth, or that, convinced of the fallacy of their reasoning, they prefer to cling to a false notion of originality rather than confess their error. Such communications, never brief, have, from time to time, been simply reiterations of previous expressions. "Correspondence with this class" of writers, as has been most truly observed by the late Secretary, is, indeed, "not only very onerous but difficult to manage, inasmuch as the rejection of their propositions is generally attributed to prejudice."

Another class of communications of a more intelligent character was

also received during the past year, relating to subjects in physics and chemistry. In accordance with the custom of the establishment, these were submitted to gentlemen eminent in the several sciences to which they pertained, who for many years have cheerfully acted as collaborators of the Institution.

Although the Smithsonian system of meteorology was several years ago transferred to the United States Signal Office, communications continue to be received on practical questions connected with this subject. These with few exceptions have been referred to General Myer, and their authors so informed.

But increase in the correspondence of the Institution is by no means wholly attributable to the sources above mentioned. As the character of the establishment has become more widely known from year to year, the number of applications for information in the line of natural history has annually increased, particularly in botany, zoology, and mineralogy. In the last branch, supposed discoveries of mineral wealth are frequently made known to the Institution, and the specimens forwarded for examination—which is always gratuitous. The determination of their character, however, seldom requires more than a *qualitative* analysis, and in the great majority of instances the specimens are found to be of no commercial value.

EXCHANGES.

There is, perhaps, no one feature of the Smithsonian Institution by which its mission for the diffusion of knowledge, if not its increase, is more thoroughly accomplished than by its extended system of international exchanges. This began in the earliest days of the Institution, from the necessity of making some suitable arrangement by which its publications might be promptly transmitted to the learned societies of America and the world, and corresponding works received in return. This required the organization of a thorough system, including special arrangements for transportation agencies in the various parts of the United States and of foreign countries; and as the machinery was sufficient to carry a larger amount of material than that belonging to the Institution itself, it was considered in strict accordance with the policy of the Institution to offer its services to other establishments.

Year by year the number of participators in the exchange was increased, and at the present date it is world-wide in its extent. With very few exceptions the institutions of learning, not only of the United States but of all America, carry on the greater portion of their scientific exchanges with the rest of the world through the Smithsonian Institution. Among the outside countries more especially to be mentioned are Canada, Mexico, Chile, Venezuela, &c.

The institutions are for the most part scientific societies publishing transactions, colleges and universities, State historical and agricultural societies, and technological institutions. All the departments of government in Washington, with few exceptions, also depend upon the same

system for their foreign relationships. The system also includes the exchange of publications of special students in science.

For a long time the Smithsonian Institution carried on this work by the establishment of agencies through which its own transmissions were distributed to their destination, and from which all the returns were collected and forwarded to Washington. Of late years, however, in certain countries, these labors have been materially lightened by a portion of the exchange being undertaken by some learned society or by the government. These being constituted Smithsonian agents in their respective countries, receive whatever may be sent to them for distribution, collect the returns and transmit them, thus giving to the Institution the benefit of an intelligent superintendence of the work. The first of these organizations was that established some years ago by the University of Christiania, Norway; and by Holland in the patronage of the Scientific Bureau at Harlem, under the efficient supervision of Dr. E. H. Von Baumhauer. During the past year a similar organization has been effected for Belgium, and it is hoped that their number will continue to increase. Even now, without any formal arrangement to that effect, the Academies of Science of Stockholm, of Copenhagen, of Madrid, and of Milan discharge the services of agents of the Institution for their respective countries.

A still more recent movement has in contemplation the establishment of departments of exchange in all countries under the direction of their respective governments; and this is intended primarily to facilitate a mutual interchange of government documents, but is broad enough in its scope to include the publications of societies and of men of science. At present this arrangement has only been carried out formally for Belgium by the "Commission Belge d'Echanges internationaux," and for France by the "Commission Française des Echanges internationaux."

In the Appendix will be found the usual series of tables, showing, first, the number of parcels sent out by the Institution in behalf of establishments in North America; and, secondly, the packages received for the same parties. The total number of shipments of boxes, containing such transmissions, has not been quite so great in 1878 as in the year preceding. This was due to the interruption of the business caused by the death of Professor Henry, and in the desire, by the reorganization of departments, to give greater efficiency to that of the exchanges. On this account a large number of bundles have accumulated, which, however, will be distributed in the earlier months of the year; after which there will be no interruption to the usual routine of transmission.

Up to the present time the entire expense of this system of international exchanges has been borne by the Smithsonian Institution, beyond requiring that all outgoing parcels be delivered to the Institution free of expense. The enormous increase, however, in the number and bulk of the packages delivered to the Institution has made it necessary to charge a small amount on this class of transmissions, and under the

authority of the board, a circular has been prepared and issued, making one of the conditions of receipt the payment of five cents per pound on the parcels. This is actually below the cost, as it includes the expense of wrapping, of boxing, of forwarding, and a share of the salary of employés and agents, and other incidentals. It is about the same rate as is charged by the express companies for freight in bulk from Washington to Chicago.

To facilitate the business connected with the system of the Smithsonian exchanges the following rules have been adopted:

1. Transmissions through the Smithsonian Institution for foreign countries to be confined exclusively to books, pamphlets, charts, and other printed matter, sent as DONATIONS or EXCHANGES, and not to include those procured by purchase. The Institution and its agents will not receive for any address apparatus and instruments, philosophical, medical, &c. (including microscopes), whether purchased or presented; nor specimens of natural history, except where special permission from the Institution has been obtained.

2. The Departments or Bureaus of the United States Government to pay the Smithsonian Institution five cents per pound on their packages, which includes all expense of boxing, shipping, and transportation.

3. A list of the addresses and a statement of contents of each sending to be mailed to the Smithsonian Institution at or before the time of transmission.

4. Packages to be legibly addressed and to be indorsed with the name of the sender and their contents.

5. Packages to be enveloped in stout paper, and securely pasted or tied with strong twine—never sealed with wax.

6. No package to a single address to exceed one-half of one cubic foot in bulk.

7. To have no inclosures of letters.

8. To be delivered to the Smithsonian Institution or its agents free of expense.

9. To contain a blank acknowledgment, to be signed and returned by the party addressed.

10. Should *returns* be desired, the fact is to be explicitly stated on or in the package.

Unless these conditions are complied with, the parcels cannot be forwarded by the Institution.

Statistics of exchanges sent during the last ten years.

	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.
Number of boxes..	112	121	108	179	196	131	208	323	397	309
Bulk in cubic feet	1,033	1,189	772	954	1,476	933	1,503	2,261	2,779	2,160
Weight.....	23,376	31,383	28,950	26,850	44,236	27,990	45,300	80,750	99,250	69,220

The following table exhibits the number of foreign establishments with which the Institution is at present in correspondence, or, in other

words, to which it sends publications and from which it receives others in return:

Foreign institutions in correspondence with the Smithsonian Institution.

Algeria	6	Iceland	4
Argentine Republic	14	India	30
Australia and Tasmania	32	Italy	187
Austro-Hungary	156	Japan	6
Belgium	112	Java	5
Bolivia	1	Liberia	1
Brazil	10	Mauritius	3
British America	20	Mexico	16
British Guiana	3	New Zealand	15
Cape Colony and St. Helena	7	Norway	25
Central America	2	Peru	4
Chili	8	Philippine Island	3
China	1	Portugal	32
Colombia	3	Russia	162
Denmark	28	Sandwich Islands	2
Dutch Guiana	1	Spain	24
Ecuador	1	Sweden	22
Egypt	8	Switzerland	73
France	327	Turkey	12
Germany	507	Venezuela	2
Great Britain and Ireland	369	West Indies	8
Greece	8	International societies	7
Holland	66		
		Total	2,333

Special reference has been made in previous reports to the arrangement by which Congress places fifty copies of all the publications of the United States Government at the disposal of the Library Committee of Congress. These copies are to be exchanged, under its direction, through the Smithsonian Institution, for correspondingly complete series of the publications of such other governments as agree to the proposition. At present, the number of sets amounts to thirty-two, and includes the following governments. Of these, several came for the first time into arrangement during the year 1878, and seventy-three boxes of the publications referred to, each box measuring seven cubic feet, have been distributed:

International exchange of government publications in 1878.

	Boxes		Boxes.
Argentine Republic	2	France	2
Bavaria	11	Germany	2
Belgium	2	Greece	2
Brazil	2	Hayti	2
Buenos Ayres	2	Holland	2
Canada (Ottawa)	2	Japan	2
Canada (Toronto)	2	Mexico	2
Chili	2	New South Wales	2
England	2	New Zealand	2

	Boxes.		Boxes.
Norway	2	Sweden	2
Portugal	2	Switzerland	2
Prussia	2	Tasmania	2
Queensland	2	Turkey	2
Saxony	2	Venezuela	2
Scotland	2	Victoria	2
South Australia	2		
Spain	2	Total	37

LIBRARY.

In accordance with the arrangement entered into shortly after the fire of 1865, between the Smithsonian Institution and the Congress of the United States, all the publications received by the Institution, in exchange or by donation, are transferred to the Library of Congress. The following enumeration represents the sum total of such increment:

Statement of the books, maps, and charts received by the Smithsonian Institution during the year 1878, *and transferred to the Library of Congress.*

Volumes:		
Octavo, or less	860	
Quarto, or larger	403	
		1,263
Parts of volumes:		
Octavo, or less	2,356	
Quarto, or larger	2,620	
		4,976
Pamphlets:		
Octavo, or less	1,953	
Quarto, or larger	463	
		2,416
Maps and charts		74
Total		8,729

Of course, as heretofore, the more important works, like the publications of the leading scientific and industrial societies and academies throughout the world, by their aggregations have continued to render the Smithsonian library one of the most valuable of the kind extant. It is believed that no collection elsewhere contains so large a number of volumes of scientific transactions and journals, or in so complete a series.

For the purpose, however, of perfecting the catalogue, it is proposed, in the early part of 1879, to print a list of what the Institution possesses of this character, inviting contributions of deficiencies and promising similar courtesy, so far as the publications of the Smithsonian Institution are concerned.

The following is a list of some of the principal works received by the Smithsonian Institution in 1878:

From the Ministry of Public Works, Commerce, and Industry, Lisbon: O Archivo Rural, vols. i–xv, Lisboa, 1858–1874, 4to. Memoria sobre a População e a Agricultura de Portugal, Lisboa, 1868, 8vo. Chimica Agricola, por J. I. F. Lapa, Lisboa, 1875, 8vo. Geographia e Estadistica Geral de Portugal e Colonias, por G. A. Perry, Lisboa, 1875, 8vo. Relatorio do Conselho Especial de Veterinaria, Lisboa, 1873, 4to. Manual de Viticultura pratica, por Visconde de Villa Major, Coimbra, 1875, 8vo. A Agricultura no Districto de Vizen, por J. B. Reis, Lisboa, 1871, 4to. Fomento da Povoação Rural em Hespana, por D. F. Caballero, Lisboa, 1872, 8vo. A Lombardia a Suisse e o Monte Rosa, por E. de Laveleye, Lisboa, 1871, 8vo. Recenseamento Geral dos Gados no Continente do Reino de Portugal en 1870, Lisboa, 1873, 4to and Atlas. A Vinha e o Vinho em 1872, por A. B. Reis, Lisboa, 1873, 8vo.

From the Society of Medical Sciences of Lisbon: Journal da Sociedade das Sciencias Medicas de Lisboa, 1836–1877, Lisboa, 8vo (54 vols).

From the Ministerio dos Negocias da Marinha e Ultramar, Direcção Geral da Marinha, Lisboa: Bullarium Patronatus Portugalliæ, curante Vicecomite de Paiva Manso, vols. i–iii, and App., vol. i, Lisboa, 1868–1873, 4to (3 copies). Examen des Viagens do Doutor Livingstone, por José de Lacerda, Lisboa, 1867, 8vo (3 copies). Relatorios dos Governadores das Provincias Ultramarinhas, vols. i, ii, Lisboa, 1875, 4to (3 copies). Tratado de Hygiene Naval, por J. B. Fonssagrives, Lisboa, 1862, 8vo (3 copies). Descripção e Roteiro da Costa Occidental de Africa, por A. Magno de Castilho, vols. i, ii, Lisboa, 1866, 8vo (3 copies). Africa Occidental, vol. i, Lisboa, 1864, 8vo (3 copies). Regulamento para o Serviço de Sande Naval, Lisboa, 1871, 8vo (3 copies). Viagem da Corveta Dom João I a Capital do Japão no Anno de 1869, Lisboa, 1863, 8vo (3 copies). Historia Ecclesiastica Ultramarina pelo Visconde de Paiva Manso, vol. i, Africa Septentrional, Lisboa, 1872, 8vo (3 copies). Ensaios sobre á Estatistica das Possessões Portuguezas no Ultramar, vols. i–v, Lisboa, 1844–1862, 8vo (3 copies). Regulament para o Serviço de Fazenda a Bordo dos Navias do Estado, Lisboa, 1875, 8vo (3 copies). Relatorio ácerca do Servico de Sande Publica, Lisboa, 1871, 8vo (3 copies). As Possessões Portuguezas na Oceania, por A. de Castro, Lisboa, 1867, (2 copies). Codigo Commercial de Signals para uso Internacional, Lisboa, 1868, 8vo (2 copies), &c., &c.

From the Australian Museum, Sydney: The Mammals of Australia, illustrated by Miss Harriett Scott and Mrs. Helena Forde. With a short account of all the species hitherto described. By Gerard Krefft. Sydney, 1871. Folio.

From the Hellenic Philological Society of Constantinople: Periodical Journal (Greek), vols. iv–viii, Constantinople, 1871–1874, small 4to. Homeric Theology, by George Konstantinidos (Greek), Constantinople, 1876, 8vo, Les Grecs de l'Empire Ottoman, par A. Synvet, Constantinople, 1878, 8vo.

From the Government of France: Direction Générale des Douanes.

Tableau général du Commerce de la France, avec les Colonies et les Puissances étrangères, 1869–1875, Paris, 1871–1876, 4to (7 vols.). Tableau général des Mouvements du Cabotage, 1869–1875, Paris, 1871–1876, 4to (7 vols.).

From the Medical Society of the State of New York, Albany: Transactions, 1807–1831, 1867–1870, 1873–1877. Albany. 8vo (9 vols.)

From the State Library of Pennsylvania, Harrisburg: Reports on Geology, Mineralogy, Oil-Wells, &c., &c. Harrisburg, 1876–1878. 8vo (21 vols.).

From the Library of the German Parliament, Berlin: Stenographische Berichte über die Verhandlungen des deutschen Reichstages. iii. sess., 1875–76, vols. i–iii; iv. sess., 1876, vols. i–iii; i. sess., 1877, vols. i–iii; Berlin, 1876–1877, 4to. Reichs-Gesetzblatt, 1875–1876, Berlin, 4to.

From the University of Chile, Santiago: Anales de la Universidad de Chile, 1875–1876 (4 vols.), Santiago, 8vo. Memoria del Interior, 1876, vols. i–ii, Santiago, 8vo. Memoria de Relaciones Esteriores, 1876, Santiago, 8vo. Memoria de Justicia, Culto, &c., 1876, Santiago, 8vo. Memoria de Hacienda, 1876, Santiago, 8vo. Memoria de Guerra y Marina, 1876, Santiago, 8vo. Sesiones del Congreso National de Chile, 1875 (4 vols.), Santiago, 4to. Anuario Estadistico de Chile, vol. xvii, Santiago, 1876, 4to. Anuario Hidrografico de la Marina de Chile, año ii–iii, Santiago, 1876–1877, 8vo. Quinto Censo Jeneral de la Poblacion de Chile, 1875, Valparaiso, 1876, 4to. Coleccion de Tratados celebrados por la República de Chile con los Estados estranjeros, tomo ii, Santiago, 1875, 4to. La Chili tel qu'il est, par E. Seve, tome i, Valparaiso, 1876, 8vo. Historia de Chile, 1831–1871, por Don R. S. Valdes, tomo i, Santiago, 1876, 8vo. La Cronica de 1810, por M. L. Amunátegui, tomo ii, Santiago, 1876, 8vo. Ensaye sobre los depósitos metaliferos de Chile, por Don I. Domeyko, Santiago, 1876, 8vo.

From the Royal Academy of Sciences, Lisbon: Memorias da Academia, Nova Serie, tomo iv, v, parte i, Lisboa, 1872–1877, 4to. Decada 13 da Historia da India, i, ii, Lisboa, 1876, 4to. Portugalliæ Monumenta, 2 parts, Lisboa, 1873, folio. Subsidios para a Historia da India Portugueza, tomo v, Lisboa, 1868, 4to. Corpo Diplomatico Portugueza, tomo v, Lisboa, 1874, 4to. Quadro Elementar dus Relaões politicas e diplomaticas de Portugal, vols. xii and xiii, Lisboa, 1874, 1876, 8vo. Flora Cochinchinensis, vols. i, ii, Lisboa, 1790, 4to. Historia dos Estabelecimentos scientificos e areisticos de Portugal, toms iii, vi, Lisbon, 1873–1876, 8vo. Jornal de Sciences Mathematicas, toms iv, v, Lisboa, 1873, 1876, 8vo. Tratado Elementar de Optica, Lisboa, 1874, 8vo. Historia de Congo, Lisboa, 1877, 8vo. Carro de Meteorologia, Lisboa, 1869, 8vo. Chimica Agricola, Lisboa, 1875, 8vo.

From the British Government: Facsimiles of National Manuscripts of Scotland, selected under the direction of the Right Hon. Sir William Gibson-Craig, Bart., lord clerk register of Scotland, and photozincographed by command of Her Majesty Queen Victoria by Colonel Sir Henry James, part iii, Edinburgh, 1872, folio.

From the Royal Library, Stockholm: Government Documents, 1877, 1878, Stockholm, 17 vols. and 8 parts, 4to.

From the Government of South Australia, Adelaide: Acts and Ordinances of the Province of South Australia, 1837–1835, Adelaide, 4to (6 vols.). Proceedings of the Parliament of South Australia, 1857–'8, i, ii; 1858, i, ii; 1859, i, ii; 1860, i–iii; 1861, i–iii; 1862, i–iii; 1863, i; 1864, i–iii; 1865, i, ii; 1865–'6, i, ii; 1866–'7, i–iii; 1867, i–iii; 1868–'9, i–iii; 1869–'70, i–iii; 1870–'71, i–iii; 1871, i, ii; 1872, i–iii; 1873, i–iii; 1874, i–iii; 1875, i–iii; and special session, Adelaide, folio (53 vols.). Statistical Sketch of South Australia, by Josiah Boothby, London, 1876, 8vo.

From the Norwegian Government, Christiania: Norges Officielle Statistik, 13 volumes and 43 parts, Christiania, 1870–1876. Forklaringer til K. Norges Statsregnskab, 1875, Christiania, 1876, 4to.

From the second geological survey of Pennsylvania: Reports 1875–1878 (20 volumes).

From the Universities of Würzburg, Marburg, Berlin, Louvain, Bonn, Halle, Göttingen, Jena, Erlangen, Leipzig, Zurich, Greifswald, Heidelberg, Dorpat, and Freiburg: Inaugural dissertations for 1877.

From Dr. A. Ernst, Caracas: Statistical documents, 24 volumes, Caracas, 1875–1877, 4to.

From the Library of Parliament, Ottawa, Ontario: 18 volumes government documents.

From the State Library of Ohio: 14 volumes State documents.

An addition of special interest will be found in the palæontological library of the late Prof. F. B. Meek, whose death at the Institution, after many years' sojourn within its walls, was recorded in the report for 1877 (p. 10). Mr. Meek died without any known heirs, and his books being appraised in due legal manner, the Institution purchased them. This was the more desirable as, in regard to many of the works there was some uncertainty whether they had been presented to Professor Meek in his individual capacity or as the officer in charge of the palæontological department of the Institution. This question is, of course, now settled. The books of this library (especially the volumes enriched by copious manuscript notes and interpolations) have been repeatedly consulted by palæontologists and conchologists.

NATIONAL MUSEUM.

The relations existing between the Smithsonian Institution and the National Museum have been so frequently referred to by my predecessor that it is only necessary to mention briefly that the Museum constitutes no organic part of the Institution, and that, whenever Congress so directs, it may be transferred to any designated supervision without affecting the general plans and operations connected with the "increase and diffusion of knowledge among men." For the most part, the articles consist of the collections made by the United States surveying and exploring expeditions, and the expense of their care is entirely covered

by government appropriations, which have been sufficient to meet the actual cost of maintenance and a restricted supervision, although with a larger fund the Museum could be placed on a more satisfactory basis, and one much more serviceable to science.

Attention has been called, in several previous reports of my lamented predecessor, to the importance of suitable provision for the accommodation of the vast amount of material now stored in the Armory building and in the basement of the Smithsonian edifice, and thus withdrawn from public examination. This surplus consists of the following essential elements:

First, the collections made by the United States exploring expeditions.

Second, the contributions sent by private individuals who reside in every section of the country.

Third, the exhibits of the Smithsonian Institution, the Indian Bureau, and the United States Fish Commission, at the Centennial.

Fourth, the donations to the United States by domestic and foreign visitors and commissions on that occasion.

The number of private contributions to the National Museum continues to increase in value and magnitude year by year, and embraces specimens of mineralogy and geology, objects of American antiquity, and other desirable articles. The government surveys, too, of Messrs. Hayden, Wheeler, and Powell have furnished a very large number of specimens of great value as illustrating the reports published by these parties. It is, however, under the two last-mentioned heads (the Centennial exhibits and donations) that by far the greater amount of this unexhibited material is comprised.

By means of an appropriation by Congress, as fully set forth in the Reports for 1875 (pages 8 and 46) and for 1876 (pages 8–11, 42, and 75–77), the Smithsonian Institution was enabled to exhibit a very full collection illustrating the animal and mineral resources of the United States; the Fish Commission to present every variety of boat, net, hook and line, harpoon, and other fishing implements, as well as models and illustrations of all the fishes useful for food or other purposes; the Indian Bureau to show a valuable representative ethnological series of ancient implements, of dressed figures, and of objects illustrating the life and customs of the North American aborigines.

At the close of the Exhibition, the foreign commissioners, induced by a desire to do honor to the United States, presented, with scarcely an exception, the whole of their exhibits (corresponding with those made by the Smithsonian Institution) to the United States Government, embracing the contents of many thousands of square feet in the different Centennial buildings. Of forty-one foreign commissions, thirty-four gave to the United States either the whole of their displays or a full series, probably representing 75 per cent. of all such matter as was shown under the patronage of the respective governments.

Many private exhibitors from abroad made similar contributions, some

of these valued singly at over $20,000 each. A large proportion, too, of the more desirable exhibits by State commissions, as also of home exhibitors, was added to the mass, and nearly two months were spent at the close of the Exhibition in simply removing these articles to the government building and there packing them for transportation to Washington, a large force being required for the purpose.

The collection sent from Washington to Philadelphia filled twenty freight cars, and the donations received at the Centennial required forty more for their transportation, the entire amount to be brought to Washington making sixty car-loads, a quantity far beyond the storage capacity of the basement of the Smithsonian building.

In anticipation of these donations, Congress had previously authorized the transfer to the Smithsonian Institution, for the purpose of storage, of the Armory building, on the square between Sixth and Seventh streets, and made an appropriation to fit it up for the reception of the collections. To this building a portion of these collections was transferred, where they now fill four floors, of about 5,000 square feet each, from top to bottom, the remainder being stored in the basement of the Smithsonian Institution. At present, with the articles received from other sources, it is estimated that the quantity of objects not exhibited represents nearly five times the bulk of those at present displayed in the Smithsonian building.

It is to be understood, too, that these objects are not simply specimens of natural history, possessing an abstract interest to the student, but represent the application of natural objects to the industries, and as such are of great importance. In what is now a fairly complete series of economical minerals, such as ores, combustibles, building stones, clays, earths, &c., from all parts of the world, with their incidentals of reduction and application, and specimens of similar objects of art and industry derived from them, we have a collection of very great industrial importance, for it furnishes to the American manufacturer and designer information of the utmost value. The illustrations of means and appliances for the pursuit, capture, and application of food-fishes, from all parts of the world, are also of exceeding value, while the articles of Indian manufacture from Alaska, Washington Territory, and the Prybilov Islands are of the utmost interest.

Several donations from foreign countries are of considerable magnitude and importance; the first being from the King of Siam as a present to the United States Government; the second the display of the manners and customs of the Chinese made by the Chinese Commissioner; the third an exhibition of the industries illustrating the manners and customs of the Japanese, presented by the Japanese Government. The intrinsic value of all these objects presented to the United States is very great, having probably cost their respective contributors, either governments or individuals, not far from three-quarters of a million to a million of dollars.

The necessity, therefore, of some adequate means of displaying this rich collection, now withdrawn from the inspection of the public, has weighed very heavily upon the officers of the Smithsonian Institution, and several efforts have been made to secure an appropriation from Congress for the erection of a fire-proof building sufficient to contain it, but of the most inexpensive form of construction compatible with protection against fire, and allowing the greatest convenience of display. A plan was prepared on the basis of suggestions from General Meigs, and approved by the Committees on Public Buildings and Grounds of both the Senate and House. The Senate, at the second session of the Forty-fourth Congress, passed a bill appropriating $250,000 for the erection of a building of the kind, without a dissenting vote. This also passed the House; but obtained only a majority vote, under circumstances requiring a two-thirds vote.

A bill making an appropriation for the erection of such an edifice was again introduced into Congress at the current session, which it is hoped will be more successful. Owing to the particular form of construction of the proposed building, it can be completed in probably not more than a year, and the collections removed into it.

It is now proposed to place this building in the southeastern corner of the reservation of 52 acres, situated between Seventh and Twelfth streets and North and South B. It will be so situated as not to obstruct the view of the Smithsonian from the Capitol or from any other important point. As originally contemplated, the building was to occupy the space between the present Smithsonian edifice and Twelfth street; but it was finally concluded that if placed there it would obstruct the view of the Agricultural building, and the change of location was accordingly determined upon.

Attention was called by the report for 1877 (page 36), to the continued increase of the number and variety of the collections received during the year, the exceptional year of the Centennial being the only one that furnished a larger quantity of material. The returns for 1878 have again been much larger than usual, exceeding considerably those of the previous year. The total number of donors was 635 for the year, to 335 in 1877, of which 180 were contributors to the collections of the United States Fish Commission at Gloucester. The number of donations was 455, to 489 in 1877; and of separate packages 1,197, to 815 in 1877. A large part of the increase is due to the extensive contributions made to the United States Fish Commission by the fishermen and merchants of Gloucester, Mass., in which city the Commission has had a station for the prosecution of researches and the propagation of food-fishes during the last half of the year. The hearty appreciation, by all classes of the community, of the operations of the Commission, caused those fishermen residing at the port to save many articles brought up on the trawls from the deep water, and to bring them to the office of the Commission at Gloucester. The result is to be seen in several hundred donations, some

of them embracing specimens of very great interest, and adding largely to our knowledge of the distribution of animal life in the waters off the coast of New England. As the result of these contributions, together with the gatherings of the Fish Commission itself, many species of fishes and of marine invertebrates have been added to the fauna of the country, several of them being entirely new; others were previously found only in the deep waters off the European coast or in those of Spitzbergen and Greenland.

Reference is, of course, quite impossible to even a small percentage of those collections added to the National Museum during the year covered by the present report, and they will be found under the names of the donors, alphabetically arranged, in the appendix. Even this, however, fails to give a complete idea of the magditude of the additions, as a collection embracing from five to twenty or more boxes may be included in a single line of the record. The books of the Institution, in which all these articles are entered systematically, give a more detailed statement; and the fact that a portion of these has required 9,973 entries, will furnish some idea of the aggregate.

Among the more important general collections received are those made by the United States Fish Commission at Gloucester, as already referred to, embracing a complete and exhaustive series of the marine animals of the ocean between the New England coast and that of Nova Scotia, Newfoundland, and the outer Banks, including the Georges, the Grand Banks, Flemish Cap, Le Have, Bank Quero, &c. This material embraces a great many duplicate specimens, which will, in time, be distributed to the educational and scientific establishments of the United States.

Next to this in importance and magnitude are two collections from the far North, one from E. W. Nelson, Signal Office observer at St. Michaels, in Alaska, consisting very largely of ethnological articles and birds; the other made by Mr. L. Kumlien, while a member of the Howgate expedition to Arctic America, this embracing much the same class of objects as those sent by Mr. Nelson.

The collection of birds and ethnological articles, gathered by Mr. Ober in the islands of the West Indies, to which further reference will be made, has also been of great moment. Mr. J. Zeledon, formerly an assistant in the Institution, and for many years resident in Costa Rica, visited Washington in the spring of 1878, bringing a very large collection of birds, mammals, &c., of his country.

Large collections have also been received from Lieut. George M. Wheeler, the proceeds of the expeditions of 1877 and of earlier years, transmitted by him in accordance with the law of Congress requiring their deposit in the National Museum.

In another part of the report will be given a more detailed account of some of the explorations to which reference has been made.

Following the plan of previous reports, we shall now proceed to indi-

cate, briefly, the character of the more important additions to the Museum in systematic sequence with some reference to the result in increasing our knowledge of particular regions.

Anthropology.—Beginning with anthropology as the most interesting and important of such additions, I may refer again to the collections made by Mr. Nelson at Saint Michaels. These are very exhaustive and complete, and taken in connection with those sent by Mr. Lucien M. Turner from the same region supply a very full illustration of manners and customs of the Indian and Esquimaux races found in northwestern America. A special feature of Mr. Nelson's collection, like that of Mr. Turner, is the immense variety of carvings in bone and wood, representing various animal forms either in contour or in simple lines; the latter calling to mind the engraving upon bone, especially of antlers of reindeer found in the caverns of France and Germany, and throw much light upon the region and character of these remains. Many models of boats, traps for securing animals, fishing apparatus, articles of clothing, and many other objects constitute the mass of the great collection sent by Mr. Nelson.

Not at all inferior in interest, and only less in extent, are the collections of Mr. Kumlien made by him during several months' residence at Cumberland Gulf, in Arctic America, and on the opposite coast of Greenland. They include great numbers of ancient stone implements found in the Esquimaux graves, and supply a previous deficiency in the collections of the National Museum. There are also many articles of dress and adornment, implements of war, and the chase, &c. In the last year's collections of both Mr. Nelson and Mr. Kumlien are many stone implements, objects of horn, bone, or wood, illustrating in a very high degree the functions and applications of certain articles of stone familiar to the American archæologist, the uses of which were previously conjectural. These embrace scrapers, knives, planes, gouges, drills, and many other articles.

During the past year the attention of the Institution has been called especially to the subject of the soap-stone quarries, where the aborigines obtained their material for soap-stone bowls, dishes, &c., constituting so common a feature in American archæology, but the source of which has been heretofore but little noticed. Of these quite a number were met with during the year, and an examination more or less extensive has been made of each under the auspices of the Smithsonian Institution.

During the spring of 1875, some specimens of steatite were received from the quarry of John B. Wiggin, in Chula, Amelia County, Virginia. Among these were fragments of rude vessels, which, from their number and unfinished condition, were regarded as indicating that the place in question was once an aboriginal mine. Mr. Wiggin was requested to carefully save and forward all specimens of the kind which he might discover; and the receipt from him during the centennial year of an additional collection proved beyond doubt the correctness of the conjecture.

Inasmuch as, at the time, no quarry of this kind had been discovered,* and as, moreover, aboriginal methods of mining and working pot-stone were entirely unknown, it was thought advisable to have a careful exploration of the place undertaken, which was intrusted to Mr. F. H. Cushing, who visited the locality in June last, causing excavations of sufficient extent to be made to reveal a large portion of the rock-surface worked by the Indians. Again, in August and September, furnished with suitable instruments, and a complete photographic outfit, he continued these investigations, and, with the sanction and kindly aid of Mr. Wiggin, was enabled to greatly extend the diggings, thus making his examination very thorough and sufficient.

The surface indications of aboriginal quarrying were found to be shallow circular depressions, from ten to seventy feet in diameter. Mr. Cushing began operations by causing a space of earth, 60 feet in length by 40 in width at the base, to be cleared away from the center of the largest of these depressions. Everywhere over the rock-surface, thus exposed he found grooves and hollows made by the Indians in taking out sugar-loaf shaped masses of the rock; and throughout the soil removed he found numerous fragments of these masses mostly hollowed as the beginning of pots, together with equally numerous rude quartz-picks, some broken axes and mauls, and a few hammers of soapstone, which had been used in quarrying and working the material.

From the base of the triangular excavation a cutting was made, about 17 feet in width by nearly 40 in length. This was extended to the left 18 feet, to remove the earth from around a large out-cropping bowlder, from the base of which it was found that the Indians had cut the rock away piece by piece, until only a slender stem remained as its support. Another extension, nearly 40 feet to the right and 30 feet wide, laid bare one side and the center of a second quarry almost as much worked as the first. From this last a ditch 3 feet wide was carried forward more than 80 feet, all along the course of which were found Indian cuttings wherever the rock-surface was exposed. Thus the area worked over by the aborigines in one direction was shown to be not less than 180 feet. How far to either side of this their work extended can only be conjectured. The number and extent of those depressions not excavated, however, seemed to indicate that less than one-third of the Indian work was exposed by the diggings just described. Mr. Cushing not only procured from the earth removed, a collection of several hundred specimens, but also made and brought away photographic views and accurate plaster models of portions of his diggings.

Attention being drawn to these explorations while in progress by notices in some of the Washington newspapers, Mr. Elmer R. Reynolds, of the city, brought to notice some similar specimens of vessels which he had found within the District, on Soapstone Run, a branch of Rock Creek,

*Intelligence had been received of some surface workings in Chester County, Pennsylvania; so slight, however, that they could hardly be regarded as quarryings.

which were recognized at once as indications of another quarry, and Mr. Cushing was directed to make a thorough examination of it. Here, as in Virginia, depressions along the hill-side in which the quarry occurred showed that the Indians had worked the underlying ledge, although excavations subsequently made revealed the fact that they had depended mainly upon surface material for their supply. Large numbers of unfinished vessels, quartz-picks, hammer-stones, &c., were here found.

Another quarry has been repored by its proprietor, Mr. M. E. Holmes, as occurring on the right bank of the Potomac above Little Falls. This, though rich in ancient remains, has not yet been thoroughly examined by the Institution.

Mr. J. D. McGuire, of Ellicott City, Maryland, called our attention to still another quarry, not unlike the one on Rock Creek, and remarkable for the fine specimens of Indian work that it furnished. Through the hospitality and kind assistance of this gentleman, Mr. Cushing was enabled during the month of December to make a personal examination of the place, and secure for the museum nearly two hundred superior specimens.

It may be well to add that since the discovery of the Virginia quarry, public attention having been drawn to this kind of research by widely circulated newspaper notices, similar sources of aboriginal supply have been discovered in Rhode Island, Massachusetts, Connecticut, Pennsylvania, Tennessee, Georgia, Alabama, and Wyoming, from several of which the Institution has already received specimens.

An aboriginal quarry, recently discovered near Providence, R. I., on the farm of Mr. Angell, was visited by myself in July, accompanied by Professor Jenks, through whose assistance I was enabled to obtain specimens of the unfinished pots and of the mining apparatus.

Reference has already been made to the plans of an extensive work on the American Stone Age, to be prepared under the direction of the Institution, to serve as a manual for this department of archæology. The publication of the circular referred to as among the publications of the Institution for 1878 has been of great benefit in bringing in both large and small collections, as will be seen by reference to the list of donations. Every part of the country is represented in these returns, which are so many indeed as to render it somewhat invidious to select any for special notice. Justice, however, to the contributors, makes it proper that I should mention a few of these in greater detail.

The first collection to be noted is that presented by Mr. A. B. Crittenden, of Middletown, Conn., a large and extensive one, made during several years of effort. This is particularly rich in the shell heap or Kjökenmoedding deposits, from Cape Cod, showing a variety and complexity not previously exhibited.

To one correspondent, Mr. J. E. Gere, of Riceville, Wisconsin, of the Institution, is indebted for an important increase of its collection of ancient copper implements. Mr. Gere, during a visit to the Institution,

three years ago, had his attention called to the paucity of such objects in the National Museum, and offered his assistance in obtaining and forwarding such specimens. As the result of his promise, the Institution has received from him during the year a large number of these articles, greatly adding to the variety of the series. Masses of native copper, plowed up by Mr. Gere on his own farm, were sent to illustrate the source of the material of these implements, and to show that it does not necessarily follow that it must have been obtained in barter or otherwise from the copper mines of the Lake Superior region.

From Mr. William Brady, of Minong, in the Lake Superior region, was received a barrel of hammers, used by the ancient miners in that vicinity, enabling us to make a very interesting comparison between these and corresponding instruments used by the Indians in working the soapstone quarries already referred to.

The collections received from Dr. Frank L. James, of Arkansas, are of great beauty and variety, as also those from Professor Randle, of Kentucky.

The result of long-continued examinations of shell mounds in Florida by Mr. Henry J. Biddle, of Philadelphia, is also of very great value.

Dr. Benjamin H. Brodnax, of Louisville, in continuation of previous sendings, has contributed articles of special interest; and the collections made in Lancaster County, Pennsylvania, by Dr. T. H. Bean and Mr. Galbraith, have also added greatly to the specimens from that State.

Among the more important collections received from regions outside of the United States is a number of implements, vases, &c., from Peru, presented by Mr. W. W. Evans, who has been for many years a correspondent of the Institution, and a contributor to the National Museum.

The archæology of Japan is represented by collections received from Professor Morse, consisting of shell-heap pickings and mound diggings on the Japanese coast. The fragments of pottery in this collection are rude and unfinished, scarcely more advanced than those found in the ancient graves and mounds of North America. They are supposed to have been the production of the Ainos of the early days, who are believed to have occupied, at one time, the entire country.

An interesting contribution to European anthropology was made by Professor Kollmann, who presented a series of crania of the earlier, although scarcely prehistoric, inhabitants of Germany.

Mammals.—While many single specimens or small collections of mammals have been received from various parts of the country, those received from Lieut. George M. Wheeler, of the Engineer Bureau, representing quite a variety of species, collected by Mr. Henshaw and other collaborators of the survey, deserve special mention.

A series of the seals of Arctic America, both of skins and skeletons, brought back by Mr. Kumlien, supplies a very important gap in the collections of the National Museum, exhibiting the variations of condition

in several species, from the fœtal to the adult state, of both sexes, with corresponding skeletons of all these gradations.

The collection brought by Mr. Zeledon includes nearly all the known mammals of Costa Rica, from the largest to the smallest, and in most admirable condition of preservation, well fitted to mount for exhibition in the National Museum.

The Zoological Society of Philadelphia has presented a specimen, in the flesh, of the *Aodad* (*Ovis Tragelaphus*), which died in the menagerie of that establishment.

From the Public Library and Museum at Calcutta, in India, under the direction of Mr. Murray, was received quite a number of specimens of Indian mammals, including skins of the smaller kinds, and a considerable number of stuffed heads of tigers and other felidæ, as well as several crania of much value.

Birds.—The collections of birds received during the year have also been extensive and important, as shown by the number of specimens entered in the record book. Principally noteworthy is the donation by Mr. George B. Sennett, of Erie, Pa., of a series of the collections made by him during the preceding year in the vicinity of Brownsville, Tex. This embraces several species new to the Museum. In view of their admirable preparation, it is proposed to mount the greater part of them for permanent exhibition in the Museum.

From Dr. James C. Merrill, U. S. Army, stationed at Brownsville, Texas, was also received a very acceptable collection of skins and eggs of birds, from that region.

The collections of Mr. Nelson in Alaska and of Mr. Kumlien in Arctic America, already referred to, embrace many species of much interest, although none actually new to the Museum.

The more important addition made to the collection has been a series of oceanic birds, found off the coast of the United States. Mr. Raymond L. Newcomb having been sent out by the Smithsonian Institution on board the schooner Marion, Captain Collins in command, for the purpose of ascertaining what were the birds occurring on the fishing-banks, in such numbers as to be serviceable in furnishing bait for the capture of codfish, he brought back a large and well-prepared collection, embracing some quite rare species, although none previously unrepresented. Some of the plumages were new, and it became possible, from the collections and his notes, to interpret the meaning of various appellations employed by the fishermen.

For the assistance rendered to Mr. Newcomb, as well as in furnishing information to the Fish Commission, Captain Collins and his crew deserve special mention.

Of extra-limital collections, those made by Mr. Fred. A. Ober in the West Indies, referred to in another part of this report, are of particular value and importance. As the result of these the National Museum is now in possession of by far the most complete series extant of birds of

the West Indies, showing better than any found elsewhere the geographical distribution peculiar to each island, and the precise distribution of those common to two or more islands.

To this end especially have contributed the labors of Dr. Henry Bryant, in the Bahamas, and of Mr. William T. March, in Jamaica; of Dr. John Gundlach, Mr. Charles Wright, and N. H. Bishop, in Cuba; of Mr. Alfred Newton, in Santa Cruz; of Mr. George Latimer, and Mr. Thomas Swift, in St. Thomas and Porto Rico; of Dr. Bryant, in Porto Rico, and of Mr. Galody, in Antigua.

Not only were many species previously described contained in Mr. Ober's collection, but he furnished types of nearly twenty new species.

A series of memoirs, by Mr. George N. Lawrence, published in the "Proceedings of the National Museum," includes lists of the collections and embraces descriptions of the new species.

From foreign regions an interesting collection, for the most part of water-birds, was sent from the Bosphorus by the Robert College of Constantinople, and one from the coast of Syria by Mr. William T. Van Dyck.

Reptiles.—Reference has been made in previous reports to a very extensive collection of casts of American fishes which were prepared originally for exhibition at the Centennial, and continued since then by the addition of new species, coming to the Institution in proper condition for reproduction.

It was determined to include the North American reptiles in the series of life reproductions of such objects as are not easily exhibited as stuffed specimens. In order, therefore, to secure living objects from all parts of the country, a circular was distributed, inviting contributions of serpents, frogs, lizards, and salamanders, in all their variety; and, as in previous appeals from the Institution for assistance, the response was generous and extensive. A large number of specimens, both of rare and common species, was received, and kept the entire force of Smithsonian artists occupied during the year.

Resulting therefrom, the National Museum now has an extremely interesting and attractive collection of these animals in their natural attitudes, either as plaster or papier maché models, and very carefully colored from sketches made while the animals were alive. In some cases it was found possible to make the casts from the living specimens, and in several different attitudes, from the same individual. As heretofore, the casting and molding have been under the direction of Mr. Joseph Palmer, assisted by Mr. A. J. Forney and Mr. William Palmer. The coloring of the reptiles has been performed by Mr. A. Z. Shindler; that of the fishes by Mr. J. H. Richard.

Besides the living reptiles referred to, quite a variety of species has been obtained from other sources, among others from Mr. Ober in his West Indian explorations. Dr. Ruth, U. S. N., the surgeon of the steamer Enterprise, in which Captain Selfridge made his exploration of the Am-

azon in 1848, also furnished a valuable collection from that river. From Dr. Hering was also received a collection of the species of Surinam.

Fishes.—As might naturally be expected, from the close connection of the operations of the United States Fish Commission with those of the Smithsonian Institution, the additions in this department have been especially noteworthy, and include not only various specimens of important scientific interest, but also many illustrating and attesting the propriety of national aid in the multiplication of useful food-fishes.

It is considered especially desirable to bring together in Washington a complete representation of the food-fishes of the United States, both inland and marine; and also such kinds from other countries as tend to illustrate the American species, or as may suggest future action in the way of their introduction and acclimation in the New World.

The series of species of the salmon family, contributed by Mr. Livingston Stone from the salmon-hatching establishment on the McCloud River, in the Upper Sacramento Valley; and those furnished by Mr. Charles G. Atkins, from his works in Bucksport and Grand Lake Stream in Maine, have constituted the most important additions of fresh-water species; while the special labors of the United States Fish Commission at Gloucester, Massachusetts, aided by the fishermen of that place, have brought to light nearly 20 forms of deep-sea fishes, previously unknown.

Next to the collections from the station of the United States Fish Commission at Gloucester, the most important additions to the marine fishes have been received from Mr. Vinal N. Edwards, for a long time an employé of the Commission, and stationed at Wood's Holl, whose vigilant attention to the subject brought to light a number of additional species, so that now the Wood's Holl record embraces nearly 140 different kinds.

From Mr. Silas Stearns, of Pensacola, while connected with the Pensacola Ice Company; from Mr. James C. Leslie, of Charleston; from Mr. Samuel Powel, of Newport; from Dr. Porter, U. S. A., and Mr. Moore, of the Tortugas, have come many additions to our knowledge of the distribution of species, through their contributions to the National Museum.

The Museum is also indebted in a very marked degree, as for many years past, to the services of Mr. E. G. Blackford, the well-known fish dealer of Fulton Market, New York, for the transmission of many valuable specimens. By an arrangement with the wholesale dealers and the fishermen, this gentleman is always notified of the appearance in the market of specimens that are believed to have an interest, either from their novelty or any other cause, and, in the exercise of an excellent judgment, whatever is thought will be valued in Washington is promptly transmitted to the National Museum. To no other single person is the Institution indebted for so many favors in this direction as to Mr. Blackford.

From the museum of the Wesleyan University, at Middletown, have been received a considerable number of fishes, collected in the Bermudas by Mr. G. Brown Goode; from Professor Felipe Poey also a number of

Cuban fishes, which have an especial value, as being types of his proposed memoir on the subject, which, should it appear on the scale contemplated, will be the most extensive work ever published on the fishes of any country.

From the west coast of the United States the most important additions have been of the fishes of Alaska, sent by Mr. E. W. Nelson, from Saint Michaels, and those of Puget Sound, by Mr. James G. Swan.

In the collection of fishes gathered in Cumberland Gulf by Mr. L. Kumlien, while connected with the Howgate Expedition, were several of kinds new to the fauna of northeastern North America, and others of great value as illustrating the species obtained by the United States Fish Commission at Gloucester, either by its own efforts or by the aid of the fleet of fishermen belonging to that port.

The Natural History Museum of Paris has contributed a series of the fishes of France and the Mediterranean. A series of the fresh-water fishes of Northern Siberia has been furnished by Dr. Otto Finsch as the result of his recent well-known explorations.

Among the more noticeable results of recent efforts to extend and increase the useful food-fishes of the United States, that have come to hand, are specimens of full-grown shad from the Sacramento River, contributed by Mr. Thomas Bassett; a pair of shad from the Ohio, by Mr. William Griffith, of Kentucky; a mature salmon from the Connecticut River, obtained through Mr. E. G. Blackford; one from the Delaware, weighing 23 pounds, presented by Mr. E. J. Anderson, Fish Commissioner of New Jersey; and one of 19 pounds, taken in the Susquehanna, by Mr. Frank Farr near the shad-hatching station of the United States Fish Commission, five miles below the railroad bridge at Havre de Grace. In addition to these, many specimens of young California salmon and of landlocked salmon have also come to hand.

Invertebrates.—In the department of invertebrates the collections have been largely confined to the marine species, especially as no particular effort is now made to gather the insects which form the great body of terrestrial forms. By an arrangement between the Smithsonian Institution and the Department of Agriculture, all the collections in the line of insects and terrestrial articulates generally are transferred to the care of that department, where, under the supervision of its entomologist, they are likely to render excellent service.

Of land and fresh-water mollusca quite a number of specimens have been received and properly cared for. Of marine invertebrata most gatherings have been secured, especially through the efforts of the United States Fish Commission, at Gloucester, the labor being performed under the special direction of Prof. A. E. Verrill, of Yale College, assisted by Messrs. Richard Rathbun and Warren J. Upham. In this service, however, the work connected with the collection and arrangement of the marine mollusca was under the direction of Mr. Sanderson Smith, of New York, a competent conchologist, the value of whose

gratuitous services to the Fish Commission and to the Smithsonian Institution is not easily to be overestimated.

With the assistance of the extensive and powerful apparatus on board the Speedwell vast numbers of specimens of all kinds were secured, appropriately assorted, and packed by the gentlemen referred to, and are now in charge of Professor Verrill at New Haven undergoing the necessary examination for their arrangement and identification. A great number of duplicates was obtained for the purpose of supplying sets to educational and scientific institutions throughout the country.

A collection of fossiliferous rocks, brought up from time to time by the trawls from the various banks of the New England coast, and found in the possession of various citizens of Gloucester, by Mr. Warren J. Upham, while connected with the Commission, revealed, under the critical labors of Professor Verrill, Mr. Smith, and himself, the existence of a submarine formation quite different from any now known on the land, and embracing a number of new species, and others in peculiar combinations. The idea has been suggested by Professor Verrill that at some earlier day the whole or the greater part of the interval between North America and Europe, extending possibly as far north as Iceland, was occupied by a continent, which, after a certain amount of erosion and excavation, was submerged, the plateaus or highest remaining portions constituting a portion of the banks, which furnish such rich harvests. The indications of this deposit are believed to be found at Gay Head on Martha's Vineyard, and possibly at Siasconset in Nantucket, in the Georges, at Le Have and Quero Banks, the Grand Banks, Flemish Cap, &c. Of course so important a generalization will require further determinations, and it is hoped that the labors of the Fish Commission during the coming year may tend to solve the problem.

In the collections made by the several methods, and from the several sources referred to, are to be found all the orders and classes of marine invertebrata, such as radiates, mollusks, worms, crustacea, &c.

Apart from the collections of shells and of invertebrates referred to, we may mention a valuable collection of shells of Florida, presented by the Chicago Academy of Sciences, and of those of the German seas, by Professor Möbius.

Of terrestrial fossil remains from the land no important additions have been made. Among those received, however, there is an interesting and valuable collection of species from California, presented by Hon. A. A. Sargent, United States Senator from that State, and a Regent of the Smithsonian Institution.

Reference has been made to the arrangement with the Department of Agriculture, by which that establishment receives all the collections of land articulates; and a similar arrangement has been made in regard to the plants, special efforts in regard to that branch of natural history being left to the department. All the specimens offered spontaneously or collected by government expeditions have been turned over

to the department as soon as received. The most important of these consist of a series of species from Japan and Asia, presented by the Botanic Garden of St. Petersburg. Professor Sargent, of the Botanic Garden at Cambridge, has contributed quite a number of valuable living aquatic plants for the purpose of embellishing the United States carp-ponds on the Monument lot in this city, and of furnishing desirable food for the herbivorous fish.

Dr. William G. Farlow, of Cambridge, while associated with the Fish Commission at Gloucester, made a large collection of marine algæ, of which, as heretofore, a part will be presented to the National Museum.

A circular issued by the Institution some years ago, relative to the habits, &c., of the grasshopper and other insects, elicited many responses, which were referred to Prof. S. H. Scudder. The material, however, was never fully worked up, and it has been transferred, with the consent of the Institution, by Professor Scudder, to the United States Entomological Commission lately organized by Congress.

I have thus furnished as briefly as possible a review of some of the more important contributions to the National Museum, but as the limit of space has prevented my going into much detail, I have been obliged to make selections from large numbers of contributions of value fully equal to those specially noted. All these, as stated, will be found in the list of donations entered in the record-books of the Institution. Every specimen received has, as far as possible, been recorded in its proper register, with a number affixed in some irremovable form; and whenever the size of the specimen would admit, with the name of the locality and of the donor attached. Of these entries no less than 9,973 have been made during the year, as shown by the table at the end of this Report. As heretofore explained, however, one entry may embrace a large number of specimens, especially of the same general character, without any special individuality, gathered at the same date, in the same locality, and received from the same person. It may fairly be assumed that the total number of pieces actually recorded and provided with numbers amounts to 15,000.

Considered with reference to geographical distribution—illustrating the several faunas of the various quarters of the globe, as would naturally be expected, by far the greater portion of these accessions has been received from North America, the regions from which the most important materials have been derived being Alaska, furnished by Mr. Nelson, Arctic America, by Mr. Kumlien, and the eastern coast of New England by the Fish Commission itself and its friends at Gloucester; of fishes and invertebrates from Puget Sound by Mr. Swan, fishes of the Upper Sacramento by Mr. Stone, fishes of Florida by Mr. Stearns, Dr. Porter, and Mr. Moore; and general collections by Mr. Ridgway, are among the most noteworthy.

From South America were received ethnological specimens from Peru,

by Mr. W. W. Evans; fishes and reptiles from the Amazon, by Dr. Ruth, U. S. N., of the United States steamer Enterprise.

From Mexico valuable specimens have been received from Professor Dugés, consisting especially of mammals, birds, reptiles, and fishes; illustrations of the ethnology and zoology of Guatemala have been furnished by Dr. Flint and United States Minister Williamson.

Of the animals of Surinam, collections were sent by Dr. Hering; of the vertebrata of Costa Rica, generally in a large variety, by Mr. J. Zeledon; of the fishes of Cuba, by Professor Poey; general collections from various islands of the West Indies, by Mr. Ober; fishes of Bermuda, by the Wesleyan University, of Middletown, collected by Mr. Goode; fishes and archæological remains from Japan, by Prof. E. S. Morse; the fishes of France and the Mediterranean, by the Museum of Natural History, Paris; of Northern Siberia, by Dr. Finsch, of Bremen; skins, skulls, and heads of the mammals of India, by the Public Library of Kurrachee.

Mineralogy.—In the department of mineralogy and geology, as usual, additions of many specimens, including several large collections, have been received, as it has now become quite a common thing for people all over the United States to send samples by mail or otherwise to the Institution for determination.

Many valuable additions have been made by the officers of the Land Department of the Interior, especially by Mr. John Wasson, surveyor-general of Arizona, and Mr. Hardenberg, the surveyor-general of California. By far the most noteworthy and important addition in this line, has been that of the greater part of the Swedish exhibit of iron, steel, and other metals, made at Philadelphia in 1876. The valuable iron and steel exhibit by the Swedish Commission at the Centennial Exposition had in part been promised to the American Institute of Mining Engineers, and at its solicitation any effort on the part of the Smithsonian Institution to secure the remainder for the government was waived in its behalf. It appears, however, that the necessary arrangements for their acquiring this collection were not completed, and during the year 1878, Dr. Joshua Lindahl, the representative of Sweden in connection with the Permanent Exhibition, offered the remainder of the collection as it stood, to the National Museum. This proposition was, of course, very gladly accepted, and the collection was duly transmitted under the direction of Mr. Thomas Donaldson, including the greater part of the display of the Iron and Steel Mining Company of Motala, and the iron and steel of Sandvik, a well-known and conspicuous Swedish establishment.

The institution received also, on special deposit, through the aid of Dr. Lindahl, the immense mass of native iron, weighing five tons, the smallest of three nuggets brought from the island of Disco by the Swedish Government, the one referred to having been presented to Professor Nordenskjöld, who had charge of the transfer, and by him sent for exhi-

bition to Philadelphia. Opinions of experts are at present divided as to whether this is actually of meteoric origin, or a representative of almost the single instance of metallic iron in considerable masses, as a native metal. Whatever be the actual fact, it makes no difference in the interest of the specimen; and its acquisition, even for a short time, by the National Museum, is a subject of congratulation.

Scientific investigation of collections.—As in previous years the collections of the National Museum, in charge of the Smithsonian Institution, have been freely open to the examination of competent investigators. It is preferred, of course, that this work be prosecuted in Washington; but where it is impossible to do this there is no hesitation in sending articles or collections, under suitable conditions, to any part of the world.

Most of this work of investigation is done by the resident naturalists connected with the Smithsonian Institution, directly or indirectly—the mammals by Professor Gill and Dr. Coues; the birds by Mr. Robert Ridgway; the reptiles by Dr. H. C. Yarrow and Dr. Bean; the fishes by Professor Gill, Mr. Goode, and Dr. Bean; the mollusks and marine invertebrates by Mr. William H. Dall; the insects by Professor Riley; the fossils by Prof. Charles A. White; the minerals by Dr. F. M. Endlich; the plants by Dr. Geo. Vasey.

Outside of Washington the principal collaborators have been, for the mammals, Mr. E. D. Alston, London, and Mr. J. A. Allen, of the Museum of Comparative Zoology, Cambridge, Mass.; for the birds, Mr. George N. Lawrence, of New York, Dr. P. L. Sclater, of London, and Mr. Osbert Salvin, of Cambridge, England; for reptiles and vertebrate fossils, Prof. E. D. Cope, of Philadelphia. These gentlemen have all rendered more or less service in this connection by investigating the specimens, identifying those that were previously known, and describing the new species.

Distribution of collections.—The extent of the distribution of specimens during 1878 will be seen by reference to the table at the end of this report. It has been quite large, and has furnished much educational and scientific material. It is expected, however, that a very much larger amount will be supplied during the year 1879. There is a great number of duplicates of minerals, rocks, fossils, &c., which cannot be reached until the liberality of Congress shall appropriate the necessary means to erect the new building for the National Museum. Such building is required even for the unpacking of the specimens and the separation of the series to be reserved for permanent display. This will leave a large quantity of surplus material, of considerable variety, which will enable the Institution to supply to a good degree the wants and applications of many colleges, academies, and scientific societies throughout the country.

GALLERY OF ART.

The principle of co-operation and not of competition which has for so many years been the basis of action of the Smithsonian Institution, finds

a portion of its expression in the arrangement with the Corcoran Art Gallery. Its pictures, statuary, and engravings have for the most part been removed to the Gallery, and the remainder is being prepared for the same destination. They are not presented to the Gallery, but simply deposited, and are subject to reclamation at any time.

For many years Professor Henry was one of the trustees of the Corcoran Gallery, and was thus able to look after the interest of the Institution in its collections. I have been honored by receiving a similar appointment at the hands of the board of trustees.

The propriety of the action of the Board of Regents in directing that a first-class portrait of Professor Henry be painted, the work being executed in April, 1877, by Mr. Le Clear, of New York, has been fully justified. His picture is now exhibited in the Regent's room in the Institution, after having been displayed for a time at the Corcoran Gallery. Several excellent crayon heads, of life size, of Professor Henry have been executed by Mr. Ulke and copies have been ordered for Princeton College and other institutions where Professor Henry's was an honored name.

UNITED STATES FISH COMMISSION.

Attention has been called in the reports of my lamented predecessor to the extent to which the time of the officers of the Smithsonian Institution has been occupied in the prosecution of labors undertaken by direction and in behalf of the general government; his own record of twenty-six years' service in connection with the Light-House Board, for a large portion of the time its chairman: his service on various special boards, such as those for the selection of building-stones for the Capitol, for the consideration of the question of ventilation of the Hall of the House of Representatives, &c., and in many other cases, furnishing ample illustration.

My own more immediate relations to the general government commenced in 1871, when Congress passed an act authorizing the appointment of a Commissioner of Fish and Fisheries, to investigate questions connected with the condition of the fisheries of the sea-coast and the lakes, and providing that the appointment should be by the President and confirmed by the Senate, and that his services should be rendered without compensation.

Having received the appointment from the President, I commenced the work by an investigation, of several months' duration, of the condition of the fisheries on the New England coast, especially as to the supposed conditions affecting their extent and development.

In 1872 the subject of the propagation of food-fishes in the waters of the United States was added by Congress to the other duties of the Commissioner, and since then his time has been largely occupied with the prosecution of researches into the American fisheries and in the propagation and distribution of various desirable species into every State in the Union. Previous reports will be found to contain general statements

of what has been done each year; and I shall therefore give a brief account of what was done in 1878, premising that the appropriations, beginning with $5,000 in 1871, have increased with each year, until those for 1878 amounted to $78,200.

The work of the Fish Commissioner is now prosecuted under the two distinct heads of inquiry, and propagation, each with a corps of assistants, for the most part occupied in different regions of the country. The propagation department has special reference to the shad, the salmon of California, the salmon of Maine, the land-locked salmon, the white-fish, and the carp.

The invention of apparatus by Mr. T. B. Ferguson, one of the fish commissioners of Maryland, by which the hatching of shad could be prosecuted on a much larger scale than before, and under more convenient circumstances, marks a new era in the art of fish culture, experiments made by him in 1877 having been extensively prosecuted by the United States Fish Commission in 1878.

For the purpose in question four scows were fitted up in Baltimore two with suitable machinery and apparatus, and two as quarters for the men. These were taken to Albemarle Sound and established at a point on the fishery of Dr. Capehart, of Avoca, by whom every assistance was rendered in the supply of ripe fish, from which 10,000,000 of young fish were hatched out and deposited in adjacent waters or transferred to distant points.

After the season for work in that vicinity had passed, the vessels were taken to Havre de Grace and anchored about five miles below the railroad bridge, in a sheltered cove. Here a much larger number of fish was hatched out, and the young were distributed by special messengers throughout the Union. The work of distribution of the young shad was under the special supervision of Mr. James W. Milner, first assistant of the commission; Mr. T. B. Ferguson, fish commissioner of Maryland, the inventor and constructor of the hatching apparatus, however, having charge of the propagation of the shad here, as also during the greater part of the sojourn at Avoca.

The result of the new experiment was perfectly satisfactory, and so far as relates to the shad in the future, there is no limit to the amount of work that can be done other than that of the number of ripe eggs procurable.

The labor of obtaining the eggs of the California salmon at the United States hatching-station on the McCloud River, in the Upper Sacramento Valley, was also carried on on a much larger scale than ever before, it being possible, as the direct result of the propagation in the earlier part of the operations of the commission, under the charge of Mr. Livingston Stone, to procure as many eggs as were called for; and no less than 15,000,000 eggs were obtained, and partly developed, and then distributed to various State commissioners and other parties, by whom they were hatched out and planted in the waters. A large num-

ber was hatched on account of the United States Fish Commission by Mr. Frank N. Clark, of Northville, Mich., and by Mr. Ferguson, at Baltimore. These were distributed to such of the Southern and Western States as were without arrangements of their own for prosecuting the work.

Nothing was done with the eastern salmon; but the favorable results of the work initiated five or six years ago, in restoring this fish in large numbers to the Merrimack and the Connecticut, and in planting them in the Delaware and the Susquehanna, will probably induce the renewal of the station at Bucksport, Maine, during the coming year.

The operations connected with securing eggs of the land-locked salmon at Grand Lake Stream were entirely successful, although not so many were obtained as last year. These are now in process of incubation, and will shortly be distributed.

Congress appropriated a sum of money for the purpose of fitting up the two lakes in the vicinity of the Monument in the city of Washington for the culture of European carp, a considerable number of the best varieties having been obtained in 1877, and deposited with the kind permission of the Park Commissioners in the ponds of Druid Hill Park, in Baltimore. When the Monument lot ponds were in proper condition a portion of the fish were transferred from Baltimore to their new quarters, where it is hoped they will find a congenial home. A distribution of the young will probably be made in the course of 1879, enough, it is hoped, to meet a part, at least, of the demand which has already sprung up for supplying fish-ponds throughout the country.

The most important progress in practical fish culture has been made by the United States Fish Commission during the year, in the application of its methods to the production of the sea-fishes. Experiments were instituted at Gloucester, in Massachusetts, in reference to cod, the spawning season of which takes place in the winter. The establishment was properly fitted up and, after varying results, the proper method of developing them was ascertained. Many millions of the young fish were hatched out and deposited in the waters, and about 20,000 sent on to Washington for exhibition to members of Congress, and others interested in the experiment. Nothing has yet been done with mackerel, but it is believed that the arrangements prepared for the cod will be equally efficient for that fish, as also, probably, for the halibut, while many other species, such as the tautog, sea-bass, and scup, can be treated in the same way.

The importance of this new departure of the United States Fish Commission cannot be overestimated, as it gives us the means of improving, at small expense, the sea fisheries of our coast, and also furnishes the opportunity of establishing them at points where they do not at present exist. Thus, by carrying the young cod from Massachusetts and planting them on the coast of New Jersey or Maryland, of Virginia or North Carolina, there is every assurance that, in accordance with the univer-

sal rule, these fish, when ready to spawn, will return to their starting place and become the means of establishing profitable fisheries to the inhabitants of the region. It is well known that in the Southern States the fisheries, contrary to the fact in the Northern States, are of little moment in the winter season, the most prominent species coming up in the spring and returning as the waters become chilly. The establishment of cod fisheries, and possibly of those of halibut, as winter fisheries along the southern coast, will therefore be of great importance.

The second branch of the Fish Commission's work, namely, that of the investigation of the sea fisheries, was carried on at Gloucester for three months, with the co-operation as heretofore of the Secretary of the Navy in furnishing a suitable vessel, and the general work was done with more efficiency and completeness. The same vessel, the United States steamer Speedwell, used in 1877, was detailed by the Secretary for the service, and was in command of Capt. L. A. Beardslee, who had previously sustained similar relations to the Commission when in charge of the steamer Blue Light.

The longer period of service of the vessel and the more favorable station enabled the Commission to perform a very large amount of work, the results greatly exceeding those of any previous year. Important determinations were made of the character of the sea-bottom, of the temperature and chemical constituents of the sea-water at different depths, the currents, &c., while the exhaustive collections of marine animals and plants showed clearly the character of the food of the fishes, and at the same time furnished a vast amount of natural history material of the greatest scientific interest. As heretofore, special efforts were made to obtain a large number of duplicates, so that by their distribution in named sets the colleges and other educational establishments of the country might participate in the results of the labors of the Commission.

As heretofore, the labors of the Commission at Gloucester, connected with the invertebrate department, were in charge of Prof. A. E. Verrill, of Yale College, New Haven, assisted by Mr. Sanderson Smith in the department of the mollusca, and by Mr. Richard Rathbun and Mr. Warren J. Upham. The collections made, as in previous years, were placed in the hands of Professor Verrill, who is now engaged in their classification and arrangement in sets. Dr. William G. Farlow, of Cambridge, as usual, spent considerable time with the Commission, and devoted himself especially to the investigation of the marine algae.

The investigation into and classification of the various kinds of fish brought in were in charge of Mr. G. Brown Goode, a collaborator of the National Museum, assisted by Dr. T. H. Bean, of the same establishment, and by Mr. R. E. Earll.

Capt. H. C. Chester had general charge of the laboratory and the direction of the actual dredging and trawling on the steamer.

The special superintendence of the hatching of the codfish was con-

ducted by Mr. J. W. Milner, with the assistance of Mr. R. E. Earll. The propagation department was in charge of Mr. Frank N. Clark, of Michigan. The machinery was superintended by Capt. H. C. Chester, and it is to his ingenuity that we owe the construction of the apparatus by which the actual work of hatching the codfish was rendered practicable. The difficulty of using the apparatus employed for hatching shad arose from the fact that while the eggs of the shad are heavier than the fresh water, those of the cod are lighter than the salt water, and new conditions had to be devised to keep the eggs down instead of lifting them up. This problem, as already stated, was satisfactorily solved, after many experiments, by Captain Chester, who is therefore entitled to much credit for the success of the work.

HALIFAX COMMISSION.

In 1871 a convention was held by the United States and Great Britain, at Washington, for the purpose of settling certain questions at issue between the two governments, notably that of the depredations upon American commerce by Confederate cruisers, fitted out or supplied in British ports; and also certain disputed points in reference to the fisheries of British North America.

The treaty agreed upon was not ratified by the several contracting parties, consisting of the United States and the five British maritime provinces, until 1873, when commissioners were duly appointed by the respective governments, Mr. Alexander T. Galt being named by Great Britain; Governor Clifford, of New Bedford, by the United States, and Mr. Maurice Delfosse, the Belgian minister to the United States, as the third. For various reasons, and partly owing to the death of Governor Clifford, no definite action was taken until 1876, when Mr. E. H. Kellogg, of Pittsfield, Mass., was appointed to succeed Governor Clifford; and the place of meeting was fixed at Halifax, Nova Scotia, on the 15th of June, 1877, and after receiving the British claim the commission adjourned until the 28th day of July, 1877, when it reassembled and continued in session until nearly the stipulated limit, in the month of November.

The United States commissioner was assisted by Mr. Richard Henry Dana and Mr. William H. Trescott. The British commissioner had, as his counsel, one distinguished gentleman from each province, namely, Mr. Joseph Doutre, for Canada; Mr. S. R. Thomson, for New Brunswick; Hon. W. V. Whiteway, for Newfoundland; Hon. Louis H. Davies, for Prince Edward Island; and Mr. R. L. Weatherbe, for Nova Scotia.

At the request of the Secretary of State, I attended the meeting at as early a date as my other duties would permit, arriving on the 17th of August, and remaining until the 21st of October.

The British commission had on its side the minister of marine, Mr. A. Smith, assisted by Mr. W. F. Whitcher, the commissioner of fisheries.

The deliberations of the court involved a careful consideration of all

the facts and statistics of the two countries, and a vast amount of information relating to the subject was brought together in the form of testimony of witnesses and experts and by the presentation of tables, reports, and digests. The volumes of the reports of the proceedings of the commission constitute a rich field for the naturalist as well as the statistician.

Material service was rendered by the United States Fish Commission, in the collection of important statistics gathered expressly for the purpose, especially in the presentation of tables, showing the catch of fresh fish along the coast of the United States within the treaty limits. This work was more particularly under the charge of Mr. G. Brown Goode, who executed it to the entire satisfaction of the American counsel.

The occasion was made use of by me to collect information and to prepare a systematic account of what is known of the habits of the cod and mackerel, and the various methods of capturing them, the bait to be used, &c., which will form the subject of special reports hereafter.

The award of five and a half millions of dollars, as representing the value to Great Britain of the privileges conceded to the United States, has given very great dissatisfaction in this country, to the New England fishermen especially, who denounce it as unjust in the highest degree, and express the hope that at the earliest possible moment the treaty will be abandoned, even if the original condition of things be restored.

The very great lack of published information on the subject of the American fisheries, as compared with the extremely methodical and precise summaries of the Canadian authorities, has induced me to give especial attention to this subject for information in the future, and with the co-operation of the State Department, which has placed a small fund at my disposal for the purpose, I am engaged in collecting, collating, and digesting the facts and statistics in reference to the American fisheries, an information doubtless of much value on the occasion of another arbitration similar to that at Halifax. This work is more particularly in charge of Mr. Goode.

To ascertain the accuracy of the figures presented at the Halifax convention as to the catch by citizens of the United States of mackerel off the American and Canadian coast, I employed Mr. Alexander Starbuck, of Waltham, Mass., to make a new digest of the records, as shown by the State inspections of Maine, New Hampshire, and Massachusetts. His work has been completed and shows a material difference from the old figures, but without affecting the strength of the American case.

Statistics of sea fisheries.—Reference has already been made to the data relative to this subject at Halifax, and the intention on the part of the commission to secure reliable records of the catch, export, and consumption in the United States of the more important fish. For this purpose circulars were issued, requesting answers to certain questions relating to the habits, mode of capture, statistics, and disposition of the cod, the

mackerel, the mullet, the alewife, and the smelt. Also another blank inviting information as to the extent of the fishery marine, the nature of the crews, the tonnage of the vessels, the apparatus used for capture, and other incidentals. For the purpose of collecting this information, Mr. Vinal Edwards, of Wood's Holl, an assistant of the commission, was detailed to visit the fishermen along Buzzard's Bay and Vineyard Sound and obtain the data which were needed for the various purposes referred to. This was found to supplement very satisfactorily the valuable body of statistics now being collected under the direction of the commissioners of inland fisheries of Massachusetts. These gentlemen have been authorized by the legislature to require a report of the statistics in regard to the character and catch of all the pounds, weirs, and gill-nets in the commonwealth.

The results of these several circulars will be published in full in future volumes of the report, and I take great pleasure in referring to the first of the series—namely, that upon menhaden, as prepared by Mr. Goode. This is a most exhaustive and complete history of the subject in all its relationships, scientific, biological, and economical. It occupies 520 pages, and is illustrated by 30 plates. It forms one of the same series with the exhaustive paper by Mr. Starbuck upon the whale fisheries, published in the fourth volume of the reports of the Commission.

It is also proposed to direct special attention to the history of the Southern mullet. This fish in many respects represents and may be said to replace in the South the mackerel in the North. It occurs in enormous numbers, indeed such as to permit its capture in even larger quantities than the mackerel, coming in shore to spawn in immense numbers in the autumn months. It is not at all improbable that a catch of half a million barrels could easily be made, and under circumstances involving very much less expense and exposure than would be needed for taking one-quarter that number of mackerel. It is caught abundantly all the way from North Carolina southward into the Gulf of Mexico, and is destined at no distant day to represent a very important element in the resources and business of the South. At present the methods of taking and curing the fish are very inferior to those practiced in regard to the mackerel, and the fish is consequently less esteemed; but it is not improbable that in time it will be found to occupy an almost equal rank as a food-fish, and a much more important one as an article of commerce.

Another subject to which the attention of the Commission is being directed is a similar inquiry in regard to the lake herring, the whitefish, and the salmon trout, all of them species captured and cured in great quantities, and dividing with the mackerel and the cod the demand of the market.

MISCELLANEOUS.

Mr. William H. Dall, for many years an associate of the Institution, in charge of its department of conchology and marine invertebrates gen-

erally, spent several months in 1878 in a visit to Europe, especially to the zoological museums and to the co-workers in his special department of research in Northern Europe. Acting as an accredited agent of the Smithsonian Institution, he was authorized to offer its services to specialists in prosecuting their researches, and to invite exchanges of books and specimens. Many valuable alliances have been formed in consequence of this visit, and the Institution has had already the pleasure of supplying considerable material in response to calls for the same.

Availing ourselves of a visit to France in 1878, by Mr. Thomas Donaldson, whose services to the Institution during the Centennial Exhibition had been of great value, that gentleman was requested to call on Mons. de la Batut, who had presented the Institution with relics of James Smithson, and procure from him all the information he could furnish relative to the founder of this Institution. Mr. de la Batut is the half-brother of the nephew of Smithson, to whom the latter bequeathed his property, and in case of whose death it was to be devoted to founding the Smithsonian Institution. Mr. Donaldson visited Mr. de la Batut, and gathered from him a few facts of interest relative to Smithson, none of which, however, were entirely new. He also procured the following articles:

1. An engraved portrait of Hugh Percy, Duke of Northumberland, father of James Smithson and of Col. Henry Louis Dickinson.

2. A portrait of Henry James Dickinson, son of Col. Henry Louis Dickinson, the nephew and heir of Smithson. (Silhoutte profile.)

3. A paper in the handwriting of James Smithson, a copy of an article by an admiral on the cause of a shipwreck in the English channel.

4. An inventory of the personal effects of James Smithson at the period of his death, made by the British consul at Genoa.

5. An engraved visiting card bearing the inscription: "Henri de la Batut, Hotel Britannique, rue Louis le Grand, 20."

6. Copy in wax of the seal of the de la Batut family.

In addition to its irreparable loss in the death of its late Secretary, the Institution has also to lament that of a number of valued correspondents. Among those to be first mentioned is Mr. Donald Gunn, of Winnipeg, Manitoba, a veteran correspondent of the Smithsonian Institution, one of the earliest of its meteorological observers, and one who for more than twenty years has been a constant contributor of information and collections relating to the natural history of the Northwest.

Mr. Gunn was a Scotchman by birth, and entered the service of the Hudson's Bay Company in 1813; but in 1823 resigned and established himself in the Selkirk settlement in the Red River country, where he was for a long time a successful instructor of youth, and ultimately was appointed one of the judges of the court of petty sessions, holding that position for more than twenty years. He was also a member of the first legislative council of Manitoba, in 1871.

As stated, the first connection of Mr. Gunn with the Smithsonian

Institution was that of a meteorological observer. His long-continued observations of the weather are among the most reliable of those within its archives. His contributions of objects of natural history were still more important, embracing, as they did, nearly every branch in the various classes of the animal and vegetable kingdoms, and numerous collections in archæology and ethnology. Few reports of the Institution since 1850 are without some reference to his services.

In 1866 he made a special exploration, in behalf of the Institution, of the region west of Lake Winnipeg, spending considerable time in the vicinity of Shoal Lake and Lake Manitoba, in the course of which he collected large numbers of skins and eggs of birds; among the latter, several previously entirely unknown in museums. Within a year correspondence was in progress with him in regard to the renewal of this exploration.

The death of Mr. Gunn took place in the month of December, at the age of 81. It is understood that he has left behind him a minutely detailed journal of his experiences, and his relations to the colony in which he lived for over fifty years, which will doubtless be published on account of its great historical value.

Hon. William McKinley, a valued correspondent of the Institution, who died on the 2d of May, 1878, was born in Abbeville District, South Carolina, in the year 1809; became a resident of Georgia in early life; was educated at Franklin College, now the University of Georgia, where he was graduated; entered the profession of law, served as a member of the Georgia legislature; removed to Milledgeville, Ga., where he spent the remainder of his long and useful life in the active and extensive practice of his profession. He sought relaxation in other pursuits at times, none of which were more pleasing to him than the ethnological researches connected with that region, so rich in antiquarian remains, in which his life was spent. He made, within the last few years, repeated contributions of aboriginal remains to the Smithsonian Institution, remarkable for their beauty and value. Mr. McKinley also contributed a valuable paper entitled "Mounds in Georgia" descriptive of aboriginal earthworks on the sea-coast, and of the celebrated Pyramid of Kolee Mokee in Early County, to the Smithsonian Report for 1872. Further additions of antiquities by Mr. McKinley are mentioned on page 82 of the Smithsonian Report of 1875; and at the time of his death, a still later collection was in his possession, destined for the Smithsonian Institution.

Respectfully submitted.

SPENCER F. BAIRD,
Secretary Smithsonian Institution.

WASHINGTON, *January*, 1879.

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